NASA

National Aeronautics and
Space Administration

Budget Estimates

FISCAL YEAR 1984

Volume II

Construction of Facilities

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1984 ESTIMATES

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

GENERAL STATEMENT

The Construction of Facilities (CoF) appropriation provides for contractual services for repair, rehabilitation and modification of existing facilities; the construction of new facilities; the acquisition of related facility equipment; the design of facilities projects and advance planning related to future facilities needs.

The funds requested for 1984 provide for: the continuation of prior year's endeavors in meeting the facilities requirements for the Space Shuttle: Space Shuttle Payload support operations; modification of aeronautical research and development facilities; repair, rehabilitation, and modification of other facilities to maintain, upgrade and improve the usefulness of the NASA physical plant; minor construction of new facilities; and facility planning and design activities.

The projects and amounts in the budget estimate reflect Space Shuttle and Space Shuttle Payload requirements that are time sensitive to meet specific miletsones. Other program requirements for 1984 include the modification for additional chillers at Johnson Space Center; construction of frequency standards laboratory and modifications to space flight operations facility at Jet Propulsion Laboratory; construction of fluid mechanics laboratory at Ames Research Center; construction of aeronautical tracking facility at Dryden Flight Research Facility; modifications and addition for composite materials laboratory and modifications to 30 x 60-foot tunnel at Langley Research Center; modifications for small engine component testing and modification to icing research tunnel at Lewis Research Center; and relocation of 26-meter STDN antenna, Spain.

The FY 1984 program continues to meet the objectives of preserving and enhancing the capabilities and usefulness of existing facilities and to ensure safe economical and efficient use of the NASA physical plant. This request, continues the necessary rehabilitation and modification program as in prior years and continues a repair program. The purpose of the repair program is to restore facilities to a condition substantially equivalent to their originally designed capability. The minor construction program continues to provide a means to accomplish smaller facility projects which accommodate changes in technical and institutional requirements.

Funds requested for facility planning and design cover advance planning and design requirements for potential future projects, master planning, facilities studies, engineering reports and studies and the preparation of facilitly project design drawings and bid specifications.

The request for FY 1984 is $150,500,000, an increase of $53,000,000 above the appropriation for FY 1983. Outlays are estimated to be $128,600,000 in FY 1984, an increase of $6,800,000 from the estimate for FY 1983.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

PROPOSED APPROPRIATION LANGUAGE

CONSTRUCTION OF FACILITIES

For construction, repair, rehabilitation and modification of facilities. minor construction of new facilities and additions to existing facilities, and for facility plannin and design not otherwise provided, for the National Aeronautics and Space Administration, and for the acquisition or condemnation of real property, as authorized by law, [$97,500,000] *$150,500,000.* to remain available until September 30, [1985] *1986: Provided.* That, notwithstanding the limitation on the availability of funds appropriated under this head by this appropriation Act, when any activity has been initiated by the incurrence of obligations therefor, the amount available for such activity shall remain available until expended, except that this provision shall not apply to the amounts appropriated pursuant to the authorization for repair, rehabilitation and modification of facilities. minor construction of new facilities and additions to existing facilities, and facility planning and design. *(42 U.S.C. 2451, et seq.; Department of Housing and Urban Development—Independent Agencies Appropriation Act. 1983; addrtwnal authorizing legislation to be proposed.)*

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES
Program and Financing (in thousands of dollars)

Identification code 80-0107-0-1-999	Budget plan (amounts for construction of facilities actions programed)			Costs and obligations		
	1982 actual	1983 est.	1984 est.	1982 actual	1983 est.	1984 est.
Program by activities:						
Direct program:						
1. Space transportation systems	20,050	21,405	41,300	17,460	43,600	39,200
2. Scientific investigations in space	---	1,740	12,000	1,085	3,200	10,000
3. Space and terrestrial applications	---	---	---	---	---	---
5. Aeronautical research and technology	22,650	20,115	24,000	20,109	43,500	32,400
7. Supporting activity	56,000	54,240	73,200	53,577	69,900	74,700
Total direct program	98,700	97,500	150,500	92,231	160,200	156,300
Reimbursable program:						
1. Space transportation systems	2,000	16,000	5,000	3,116	13,400	6,700
5. Aeronautical research and technology	300	1,600	1,500	1,604	1,600	1,500
7. Supporting activity	---	400	1,000	784	400	900
Total reimbursable program	2,300	18,000	7,500	5,504	15,400	9,100
10.00 Total obligations	101,000	115,500	158,000	97,735	175,600	165,400

Identification code 80-0107-0-1-999	Budget plan (amounts for construction of facilities actions programed)			Costs and obligations		
	1982 actual	1983 est.	1984 est.	1982 actual	1983 est.	1984 est.
Financing:						
11.00 Offsetting collections from Federal funds.	-2,300	-18,000	-7,500	-1,727	-18,000	-7,500
Unobligated balance available, start of year: For completion of prior year budget plans:						
21.40 Direct	---	---	---	-112,616	-120,084	-72,384
21.40 Reimbursable	---	---	---	-6,900	-3,123	-5,723
22.40 Unobligated balance transferred from other accounts: Direct	---	---	---	-1,200	-15,000	---
Unobligated balance available, end of year: For completion of prior year budget plans:						
24.40 Direct	---	---		120,084	72,384	66,584
24.40 Reimbursable	---	---	---	3,123	5,723	4,123
25.00 Unobligated balance lapsing	33,426	---	---	33,627	---	---
39.00 Budget authority	132,126	97,500	150,500	132,126	97,500	150,500
Budget authority:						
40.00 Appropriation	95,800	97,500	150,500	95,800	97,500	150,500
40.00 Reduction pursuant to P.L. 97-101 See. 501 (41)	---	---	---	---	---	---
42.00 Transferred from other accounts	2,900	---	---	2,900	---	---
43.00 Appropriation (adjusted)	98,700	97,500	150,500	98,700	97,500	150,500
50.00 Reappropriated..	33,426	---	---	33,426	---	---
Relation of obligations to outlays:						
71.00 Obligations incurred, net				96,007	157,600	157,900
72.40 Obligated balance, start of year				105,628	92,492	113,592
74.40 Obligated balance, end of year				-92,492	-113,592	-142,892
77.00 Adjustments in expired accounts				-137	---	---
90.00 Outlays				109,006	136,500	128,600

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1984 ESTIMATES

SUMMARY OF THE BUDGET PLAN BY LOCATION

Location	FY 1982	FY 1983 (In Dollars)	FY 1984
Lyndon B. Johnson Space Center	680,000	---	---
John F. Kennedy Space Center	1,720,000	---	---
Space Shuttle Facilities	35,050,000	21,405,000	41,300,000
Space Shuttle Payload Facilities	---	1,740,000	12,000,000
Goddard Space Flight Center	---	2,840,000	---
Wallops Flight Center	---	2,150,000	---
Jet Propulsion Laboratory	1,000,000	---	4,300,000
Ames Research Center	18,500,000	---	3,900,000
Hugh L. Dryden Flight Research Facility	---	4,500,000	800,000
Langley Research Center	2,950,000	16,200,000	9,500,000
Lewis Research Center	1,200,000	3,915,000	10,600,000
Various Locations	9,800,000	---	1,700,000
Repair	12,800,000	14,000,000	19,500,000
Rehabilitation and Modification	17,700,000	19,000,000	24,500,000
Minor Construction	2,300,000	3,750,000	4,800,000
Facility Planning and Design	10,000,000	8,000,000	9,200,000
Subtotal	113,700,000	97,500,000	142,100,000
Reimbursement to GSA for NASA utilized property at Ellington Air Force Base, Texas, as directed by OMB	---	---	8,400,000
Total Plan	113,700,000	97,500,000	150,500,000

SUMMARY OF BUDGET PLAN BY COGNIZANT OFFICE

	FY 1982	FY 1983 (In Dollars)	FY 1984
Office of Space Flight	37,450,000	23,145,000	53,300,000
Office of Space Science and Applications	1,000	4,990,000	1,600,000
Office of Space Tracking and Data Systems	9,800,000	---	5,200,000
Office of Aeronautics and Space Technology	22,650,000	24,615,000	24,000,000
Office of Management	42,800,000	44,750,000	66,400,000*
Total	113,700,000	97,500,000	150,500,000

SUMMARY OF BUDGET PLAN BY SUBFUNCTION

Code NO.				
253	Space Flight	35,050,000	21,405,000	41,300,000
254	Space Science, Applications, and Technology	---	1,740,000	12,000,000
255	Supporting Space Activities	56,000,000	54,240,000	73,200,000*
(250)	Subtotal, General Science, Space, and Technology	91,050,000	77,385,000	126,500,000
402	Air Transportation	22,650,000	20,115,000	24,000,000
	Total	113,700,000	97,500,000	150,500,000

*Includes $8,400,000 reimbursement to GSA for NASA utilized property at Ellington Air Force Base, Texas, as directed by OMB.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1984 ESTIMATES

SUMMARY OF THE BUDGET PLAN BY LOCATION

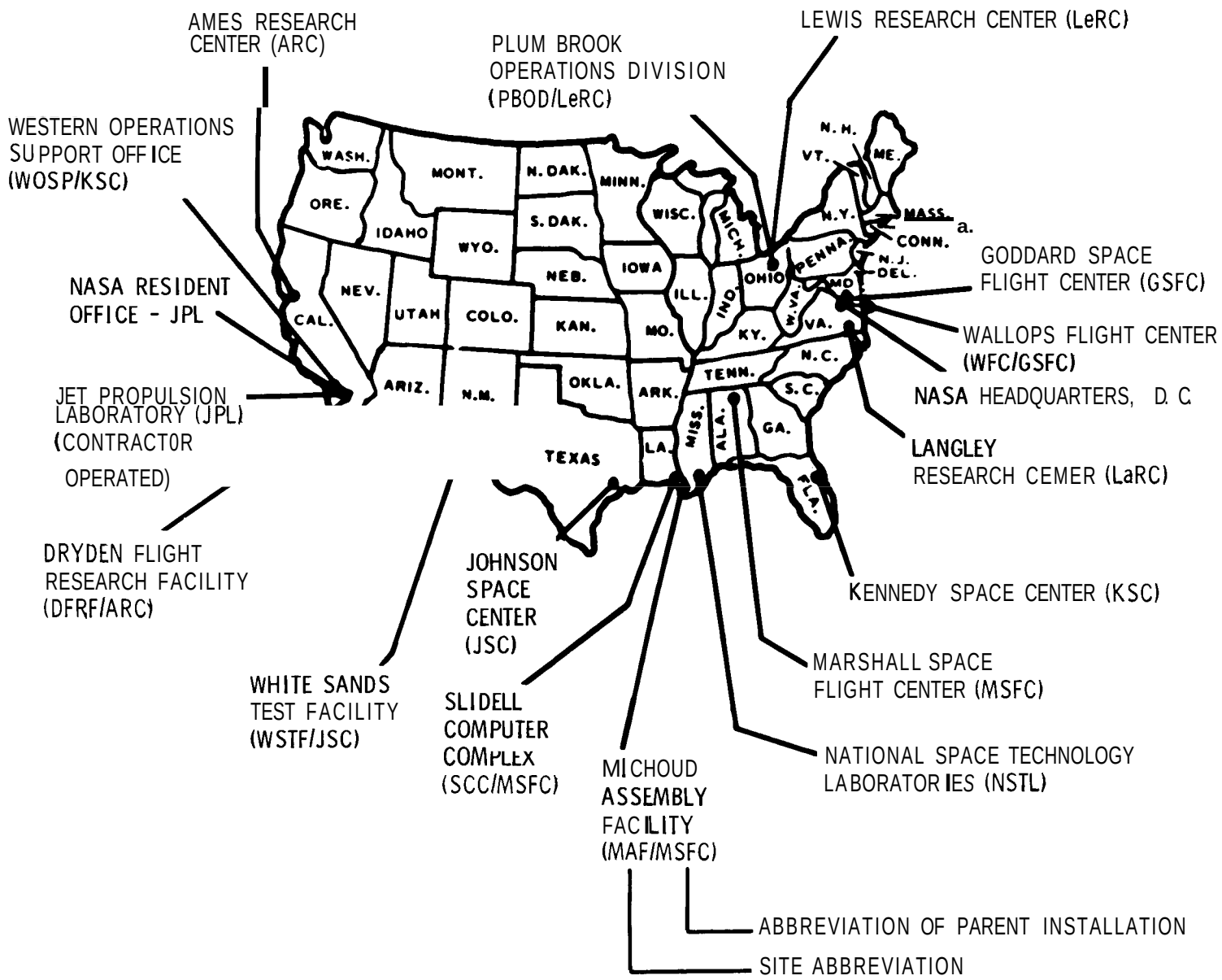
Cognizant Office	Budget Activity	Subfunction Code	Location and Project	FY 1982	FY 1983	FY 1984	Page No.
				(Thousands of Dollars)			
			Lyndon B. Johnson Space Center	680	---	---	
SF	7	255	Rehabilitation of Utility Control System, Various Buildings	680	---	---	
			John F. Kennedy Space Center	1,720	---	---	
SF	7	255	Construction of Waste Material Incinerator	895	---	---	
SF	7	255	Repair of Operations and Checkout Building Roof	825	---	---	
			Space Shuttle Facilities at Various Locations as Follows:	35,050	21,405	41,300	
SF	1	253	Modifications for Additional Chillers for Mission Control Center (JSC)	---	---	2,300	CF 1-4
SF	1	253	Modifications to Mobile Launch Platform 83 (KSC)	---	---	27,300	CF 1-12
SF	1	253	Modification of Manufacturing and Final Assembly Facilities for External Tanks (MAF)	2,785	17,845	11,700	CF 1-18
SF	1	253	Minor Shuttle-Unique Projects, Various Locations	1,115	1,860	---	
SF	1	253	Modifications to Solid Rocket Booster Refurbishment and Subassembly Facilities (KSC)	---	1,700	---	
SF	1	253	Construction of Component Ablator Facility (MAF)	15,000	---	---	
SF	1	253	Construction of Solid Rocket Booster Processing and Segment Storage Facilities (KSC)	12,400	---	---	
SF	1	253	Modifications to Building 30 for Shuttle Operations (JSC)	650	---	---	
SF	1	253	Modifications to Firing Rooms (KSC)	3,100	---	---	

Cognizant Office	Budget Activity	Subfunction Code	Location and Project	FY 1982	FY 1983	FY 1984	Page No.
				(Thousands of Dollars)			
			Space Shuttle Payload Facilities at Various Locations as Follows:	---	1,740	12,000	
SF	2	254	Construction of Cargo Hazardous Servicing Facility (KSC)	---	---	9,000	CF 2-1
SF	2	254	Modifications to Spacecraft Assembly and Encapsulation Facility (SAEF-2) for Cargo Processing (KSC)	---	---	3,000	CF 2-9
SF	2	254	Rehabilitation and Modification for Payload Ground Support Operations (KSC)	---	1,740	---	
			Goddard Space Flight Center	---	2,840	---	
SSA	7	255	Construction of Addition to Research Projects Laboratory (2)	---	---	---	
SSA	7	255	Rehabilitation and Modification of Utility Systems.	---	2,840	---	
			Wallops Flight Center	---	2,150	---	
SSA	7	255	Rehabilitation of Technical Support Buildings.	---	---	---	
SSA	7	255	Rehabilitation of Airfield	---	2,150	---	
			Jet Propulsion Laboratory	1,000	---	4,300	
ST&DS	7	255	Construction of Frequency Standards Laboratory	---	---	2,700	CF 3-1
SSA	7	255	Modifications to Space Flight Operations Facility	1,000	---	1,600	CF 3-7
			Ames Research Center	18,500	---	3,900	
AST	5	402	Construction of Fluid Mechanics Laboratory	---	---	3,900	CF 4-1
AST	5	402	Modification of 12-Foot Pressure Wind Tunnel..	18,500	---	---	
			Hugh L. Dryden Flight Research Facility	---	4,500	800	
ST&DS	7	255	Construction of Aeronautical Tracking Facility..	---	---	800	CF 5-1
AST	7	255	Construction of Data Analysis Facility..	---	4,500	---	

Cognizant Office	Budget Activity	Subfunction Code	Location and Project	FY 1982	FY 1983	FY 1984	Page No.
				(Thousands of Dollars)			
			Langley Research Center	2,950	16,200	9,500	
AST	5	402	Modifications and Addition for Composite Materials Laboratory (1293A)	---	---	5,100	CF 6-1
AST	5	402	Modifications to 30- by 60-Foot Wind Tunnel (643)	---	---	4,400	CF 6-11
AST	5	402	Modifications to the 4- by "-Meter Low Speed Tunnel	---	7,200	---	
AST	5	402	Modifications to Upgrade the Transonic Dynamics Tunnel	---	9,000	---	
AST	5	402	Modifications for Enhanced 20-Inch Supersonic Wind Tunnel	2,950	---	---	
			Lewis Research Center	1,200	3,915	10,600	
AST	5	402	Modifications for Small Engine Component Testing Facility	---	---	7,000	CF 7-1
AST	5	402	Modifications to Icing Research Tunnel (11).	---	---	3,600	CF 7-11
AST	5	402	Modification of Rocket Engine Test Facility for Altitude Testing	---	995	---	
AST	5	402	Modification to 450 PSI Air System in Engine Research Building	---	2,920	---	
AST	5	402	Modifications for High Pressure Turbine Corrosion and Thermal Fatigue Testing	I ,200	---	---	
			Various Locations	9,800	---	1,700	
ST&DS	7	255	Relocation of 26-Meter SIDN Antenna, Spain (JPL)	---	---	1,700	CF 8-1
ST&DS	7	255	Construction of Two 34-Meter Antennas	9,800	---	---	
MGMT	7	255	Repair of Facilities at Various Locations Not in Excess of $500,000 Per Project	12,800	14,000	19,500	CF 9-1
MGMT	7	255	Rehabilitation and Modification of Facilities at Various Locations, Not in Excess of $500,000 Per Project	17,700	19,000	24,500	CF 10-1

Cognizant Office	Budget Activity	Subfunction Code	Location and Project	FY 1982	FY 198	FY 1984	Page No.
				(Thousands of Dollars)			
MGMT	7	255	Minor Construction of New Facilities and Additions to Existing Facilities at Various Locations, Not in Excess of $250,000 per Project	2,300	3,750	4,800	CF 11-1
MGMT	7	255	Facility Planning and Design	10,000	8,000	9,200	CF 12-1
			Subtotal.	113,700	97,500	142,100	
MGMT	7	255	Reimbursement to GSA for NASA Utilized Property at Ellington Air Force Base, Texas as Directed by OMB.....	---	---	8,400	CF 13-1
			TOTAL.....	113,700	97,500	150,500	

LOCATION OF MAJOR AND COMPONENT INSTALLATIONS



RECORDED VALUE OF CAPITAL TYPE PROPERTY
IN-HOUSE AND CONTRACTOR HELD
AS OF SEPTEMBER 30, 1982
(Dollars In Thousands)

Reporting Installation	Real Property Land	Buildings	Other Structures and Facilities	Leasehold Improvements	Total	Equipment	Fixed Assets In Progress	Grand Total
Ames Research Center	$ 2,928	$ 220,584	$ 11,632	$ -0-	$ 235,144	$ 253,841	$ 164,695	$ 653,680
ARC-Moffett Field, CA.	2.928	220.584	11,632	-0-	235,144	247,068	164.695	646.907
Various Locations (a)	-0-	-0-	-0-	-0-	-0-	6,773	-0-	6,773
Dryden Flight Research Center	-0-	15,534	7.189	-0-	22.723	69.779	4.955	97.457
DFRC - Edwards AFB. CA.	-0-	15,534	7,189	-0-	22,723	68.677	4,955	96.355
Various Locations (a)	-0-	-0-	-0-	-0-	-0-	1,102	-0-	1,102
Goddard Space Flight Center	2.862	145.696	117.294	-0-	265.852	556.690	26.624	849.166
GSFC - Greenbelt, MD.	1,361	100,450	19,182	-0-	120,993	215,411	19,529	355,933
Tracking Stations Network	31	15,007	40,298	-0-	55,336	212,235	3,075	270,646
WFF - Wallops Island, VA.	1,470	30,194	57,776	-0-	89,440	56,799	4,020	150,259
Various Locations (a)	-0-	45	38	-0-	83	72,245	-0-	72.328
Jet Propulsion Laboratory	1,188	97,311	69,017	1,807	169,323	261,252	22,309	452,884
JPL - Pasadena, CA.	1,188	85,565	12,619	1.805	101,177	186,443	22,309	309,929
Deep Space Network	-0-	11.746	56,398	2	68,146	74,809	-0-	142,955
Johnson Space Center	9,115	201,533	65,210	-0-	275,858	602.774	31,208	909.840
JSC - Houston, TX.	5.545	165,303	38,413	-0-	209,261	363,051	26,770	599,082
White Sands Test Facility								
WSTB - Las Cruces, NM.	-0-	9,453	21,240	-0-	30,693	17,965	-0-	48,658
Various Locations (a)	3,570	26.777	5,557	-0-	35,904	221.758	4,438	262,100
Kennedy Space Center	71,345	390,154	419,677	-0-	881,176	1,549,138	72,092	2,502,406
KSC Cape Canaveral, FL.	71.345	390,154	419,677	-0-	881,176	1,543,212	72,092	2,496,480
Western Test Range Operations								
Div. STROD-Lompoc, CA.	-0-	-0-	-0-	-0-	-0-	4,254	-0-	4,254
Various Locations (a)	-0-	-0-	–0	-0-	-0-	1,672	-0-	1,672
Langley Research Center	162	137.318	299.682	-0-	437.162	193.620	44.309	675.091
LARC - Hampton, VA.	162	137,318	299,631	-0-	437,111	175.385	44.309	656,805
Various locations (a)	-0-	-0-	51	-0-	51	18,235	-0-	18.286
Levis Research Center	3.651	226.576	80.103	136	310.466	160.603	14,545	485.614
LERC - Cleveland, OH.	316	150,139	60.639	136	211,230	119.230	14,545	345.005
Plumbrook operations Division								
PBOD - Sandusky, OH.	3,335	76,437	19.464	-0-	99,236	6,275	-0-	105,511
various Locations (a)	-0-	-0-	-0-	-0-	-0-	35.098	-0-	35.098
Marshall Space Flight Center	7.164	219.216	137.255	-0-	363.635	418.113	718	782.466
MSFC - Huntsville, AL	-0-	125,711	b5.647	-0-	191.358	246.875	718	438.951
Michoud Assembly Facility								
MAF - New Orleans, LA.	7,095	83,613	58.709	-0-	149.417	31,080	-0-	180,497
Slidell Computer Complex	69	5,043	2,221	-0-	7.333	6,268	-0-	13,601
SCC - Slidell, LA.								
Various Locations (a)	-0-	4.849	10,678	-0-	15,527	133,890	-0-	149,417
National Space Technology Labs.	18.061	69.802	193.093	-0-	280.956	28.680	-0-	309.636
NSTL - NSTL Station, MS.	18.061	69,802	193,093	-0-	280,956	28,619	-0-	309,575
Various locations (a)	-0-	-0-	-0-	-0-	-0-	61	-0-	61
NASA Headquarters	-0-	-0-	-0-	-0-	-0-	17.496	-0-	17.496
Washington, DC	-0-	-0-	-0-	-0-	-0-	9,529	-0-	9.529
Various locations (a)	-0-	-0-	-0-	-0-	-0-	7,967	-0-	7,967
TOTAL	$116.476	$1,723,724	$1.400.152	$1.943	$3,242,295	$4,111,986	$381,455	$7,735,736

(a) Includes Property in possession of contractors at various locations.

JUSTIFICATION
BY LOCATION

SPACE SHUTTLE
FACILITIES

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1984 ESTIMATES

SUMMARY

SPACE SHUTTLE FACILITIES

Office of Space Flight:	Amount	Page No.
Summary.....		CF 1–1
Launch and Landing.....	29,600,000	
Modifications for Additional Chillers for Mission Control Center Lyndon B. Johnson Space Center.....	2,300,000	CF 1–4
Modifications to Mobile Launch Platform #3 Kennedy Space Center.....	27,300,000	CF 1–12
Manufacturing and Final Assembly Facilities.....	11,700,000	
Modifications of Manufacturing and Final Assembly Facilities for External Tanks, Michoud Assembly Facility.....	11,700,000	CF 1–18
Total.....	41,300,000	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1984 ESTIMATES

PROJECT TITLE: Space Shuttle Facilities

INSTALLATION: Various Locations

FY 1984 CoF ESTIMATE: $41,300,000

LOCATION OF PROJECT: Locations are identified in the following documentation.

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1983 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	7,757,000	46,910,000	54,667,000
Capitalized investment	N/A	173,294,737	173,294,737
Total	7,757,000	220,204,737	227,961,737

SUMMARY PURPOSE AND SCOPE:

The purpose of this project is to rehabilitate, modify, and add to existing Government-owned facilities, and to construct new facilities to meet unique requirements of the Space Shuttle Program. As in prior years, this Shuttle facilities package includes all major facility requirements unique to the Space Shuttle Program. In FY 1984, the proposed Shuttle facilities are primarily related to modifications to support launch operations at Kennedy Space Center (KSC) and external tank (ET) manufacturing and final assembly at Michoud Assembly Facility (MAF). Also included are modifications to the Mission Control Center at Johnson Space Center (JSC).

PROJECT JUSTIFICATION:

prior year CoF budgets for the Space Shuttle Program authorized modifications and construction of facilities for technical development, Space Shuttle Main Engine tests, ground tests, manufacturing, and launch and landing. All of the facilities to support the design development, test and evaluation portion of the program are completed and operational. The major project in this funding request is for modifications to Mobile Launch Platform #3 to support the increasing flight rate. Other projects included are modifications to manufacturing facilities for ET's to meet production requirements and modifications to chillers for the Mission Control Center at JSC. Detailed justifications are included in the project documents that follow.

As in previous requests, the projects included have been carefully reviewed against operational projections and mission capabilities to insure that they are not prematurely requested.

PROJECT COST ESTIMATE:

Launch and Landing Facilities	**29.600.** 000
Modification for Additional Chillers for Mission Control Center. Johnson Space Center	2.300. 000
Modification to Mobile Launch Platform #3, Kennedy Space Center	27,300,000
Manufacturing and Final Assembly Facilities	11.700. 000
Modifications of Manufacturing and Final Assembly Facilities for External Tanks. Michoud Assembly Facility	11.700. 000
Total	41.300. 000

JOHNSON SPACE CENTER
FISCAL YEAR 1984 ESTIMATES
MODIFICATIONS FOR ADDITIONAL CHILLERS FOR MISSION CONTROL CENTER
LOCATION PLAN

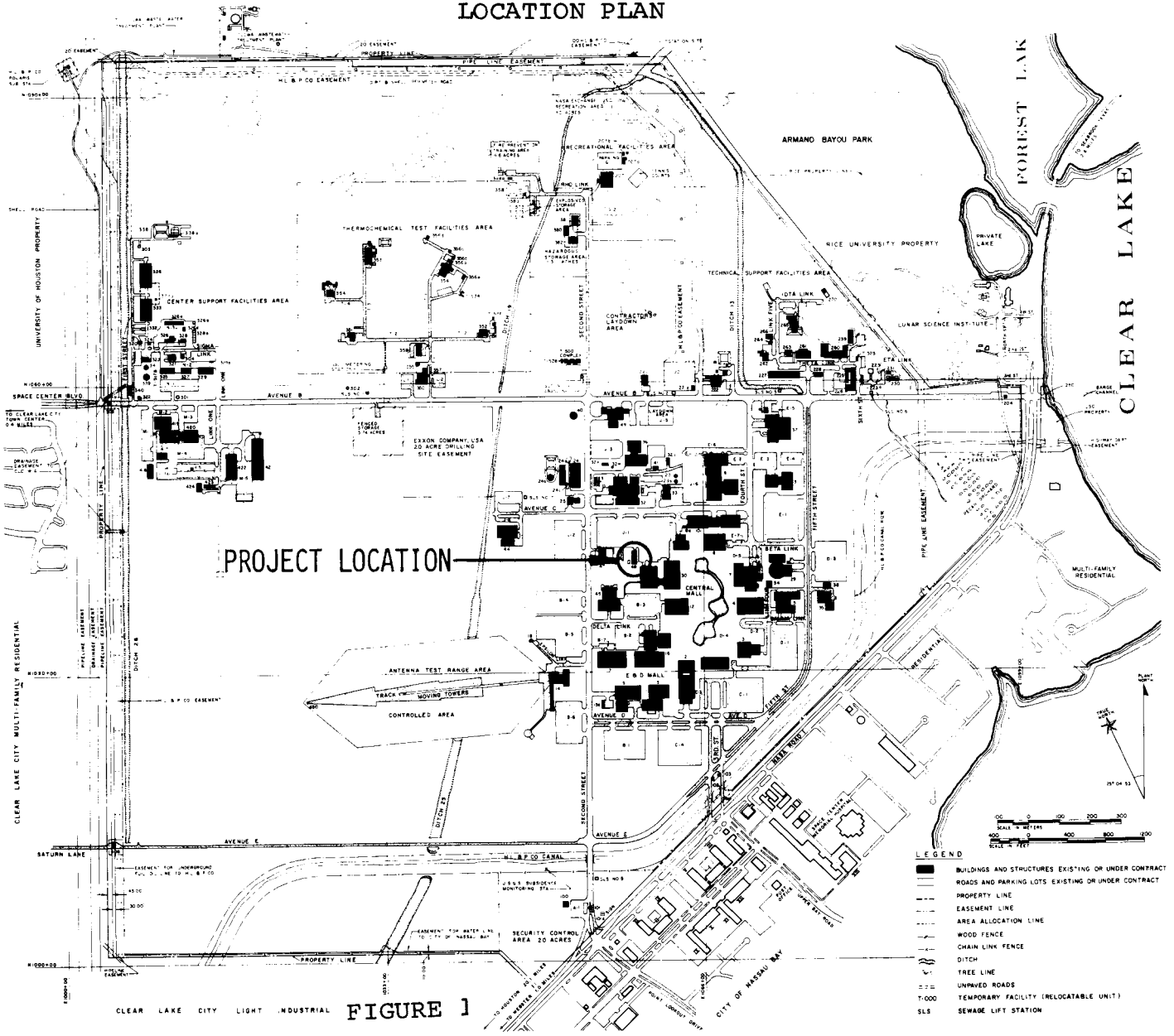


FIGURE 1

CF 1-4

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1984 ESTIMATES

PROJECT TITLE: Modifications for Additional Chillers for Mission Control Center

INSTALLATION: Lyndon B. Johnson Space Center

FY 1984 CoF ESTIMATE: $2,300,000

LOCATION OF PROJECT: Houston, Harris County, Texas

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1983 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	157,000	---	157,000
Capitalized investment	N/A	14,451,000	14,451,000
Total	157,000	14,451,000	14,608,000

SUMMARY PURPOSE AND SCOPE:

This project provides additional chilled water capacity for the Mission Operations Wing (MOW) in the Mission Control Center, Building 30 (Figure 1). During Shuttle mission control operations in warm weather, the cooling load exceeds the capacity of one of the two existing 700-ton chillers. In 1984, it is estimated that the cooling load will routinely exceed the capacity of one 700-ton chiller regardless of weather conditions. This project will provide two 400-ton electric-driven chillers and one additional diesel-driven generator for adequate on-line and standby chiller capability, and the corresonding additional electric power.

PROJECT JUSTIFICATION:

The MOW provides all mission control functions for Space Shuttle flights. The adjacent Emergency Power Building 48 houses the equipment that provides the chilled water to the MOW and generates back-up electricity for all MOW technical power. As the Shuttle flight rate increases, simultaneous operation of both flight control rooms in the MOW will be routine and one 700-ton chiller will not be adequate. The cooling loads are increasing because additional technical equipment and computers are being installed and both of the control rooms and the adjacent support areas are being used more as the flight rate increases. Metered measurements and engineering analyses have confirmed these load growths.

With the current chiller configuration, when the cooling load exceeds 700 tons, the two existing electric-driven chillers must be operated (Figure 2). Under these conditions, there is no standby chiller in the event of a failure. Also, in this mode, the second 700-ton chiller is operated very inefficiently. It provides only partial capacity cooling (approximately 250 tons) while consuming nearly full load electric power.

This project provides needed additional chiller capacity for on-line cooling loads and standby/back-up capability (Figure 3). Under peak demand, the cooling requirements will be met by one of the two existing 700-ton chillers and one of the two new two 400-ton chillers. In case of failure of either a 700- or 400-ton on-line chiller, the designated standby chiller, either a 700-ton or 400-ton unit, will be brought on line. This configuration will also permit one of the total of four chillers to be "out-of-service" for periodic maintenance.

Providing for the increased cooling loads described above also increases the MOW electric power requirement. Under less critical conditions the increased electric load would be met by using more commercial power. However, then a commercial power outage could not be tolerated. By 1984, the back-up electric power generating capacity in Building 48 (two generators on line and the third held in standby (Figure 2)) will be insufficient to accommodate the increasing technical equipment power demand plus the simultaneous operation of a 700-ton and 400-ton chiller. It is essential, therefore, that an additional diesel-driven generator be provided for adequate ,emergency back-up electric power for both the chiller load and the additional technical equipment and computers.

Of a number of alternatives studied, the above approach will have the least impact on ongoing operations when flight rate activity will be increasing.

IMPACT OF DELAY:

If the project is not approved, technical electrical power usage in the MOW would have to be restricted during flight simulations and space flights. This would cause severe operational constraints during simulations and missions. Of greater impact would be the loss of a 700-ton chiller during a high demand flight period when the remaining 700-ton unit will not carry the full cooling load. In either case, the 24 flight per year schedule could not be supported.

PROJECT DESCRIPTION:

This project provides for the construction of a 28-foot (8.53 meter) extension to the north end of the Emergency Power Building, Building 48, adding 2,178 square feet (202.3 square meters) of floor space to install two 400-ton electric-driven chillers, chilled water pumps, condenser cooling water pumps, a cooling tower cell, and installation of interconnecting piping. Electric modifications include the installation of a 2,500 kVA transformer, switchgear and interconnecting electrical cabling for powering the cooling equipment and building addition electrical systems, and a 1,700 kVA diesel driven electrical generator for increased back-up to commercial power.

PROJECT COST ESTIMATE:

This cost estimate is based on a preliminary engineering report.

	Unit of Measure	Quantity	Unit cost	Cost
Land Acquisition....	---	---	---	---
Construction.....	---	---	---	2,300,000
1,700 kVA diesel-driven electrical generator system....	EA	1	958,000	958,000
400-ton electric-driven chiller.....	EA	2	158,500	317,000
Cooling tower.....	EA	1	84,000	84,000
Water pumps.....	EA	4	11,500	46,000
Mechanical modifications.....	LS	---	---	217,000
Electrical modifications including 2500 kVA transformer	LS	---	---	364,000
Fuel oil storage tank.....	EA	1	---	35,000
Architectural-structural modifications.....	LS	---	---	261,000
Site development	LS	---	---	18,000
Equipment	---	---	---	---
Fallout Shelter (not feasible).	---	---	---	---
Total.....				2,300,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Floor Plan Existing Configuration, Building 48
Figure 3 - Floor Plan New Configuration, Building 48

OTHER EQUIPMENT SUMMARY:

No other equipment is required for this project.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

It is presently estimated that no future CoF funding requirements will be necessary to complete this project.

JOHNSON SPACE CENTER
FISCAL YEAR 1984 ESTIMATES
MODIFICATIONS FOR ADDITIONAL CHILLERS FOR MISSION CONTROL CENTER

FLOOR PLAN EXISTING CONFIGURATION

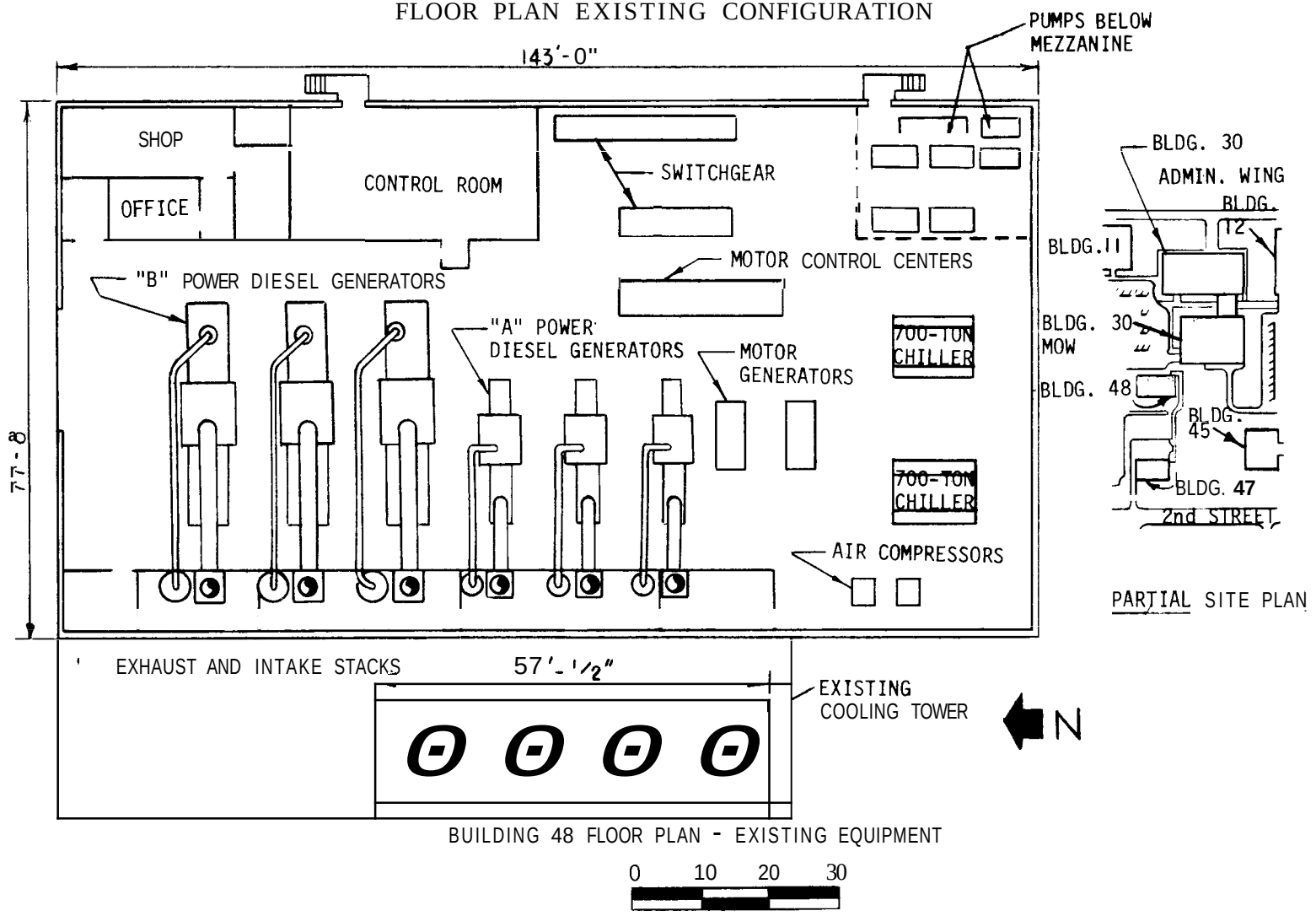
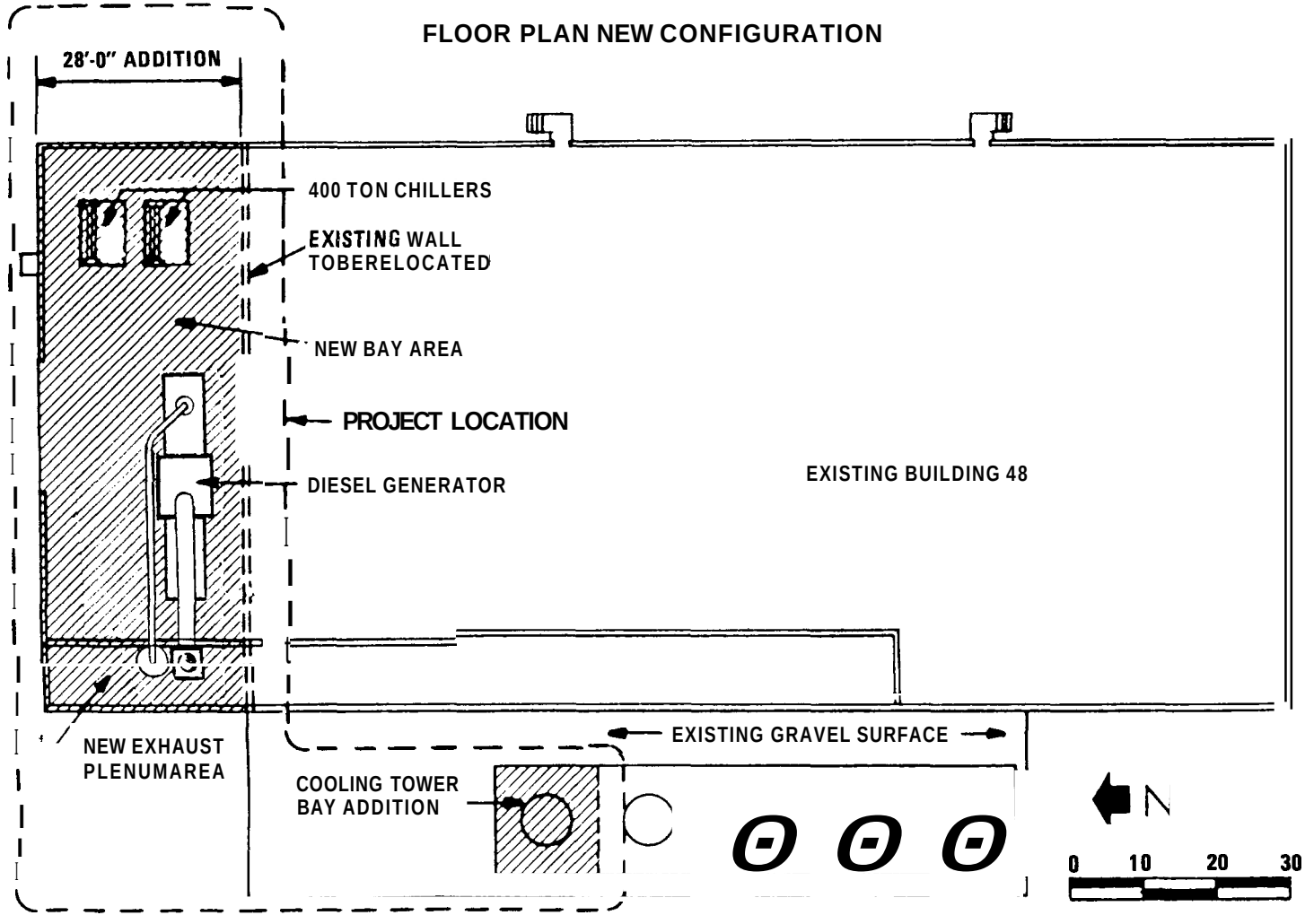


FIGURE 2

JOHNSON SPACE CENTER
FISCAL YEAR 1984 ESTIMATES
MODIFICATIONS FOR ADDITIONAL CHILLERS FOR MISSION CONTROL CENTER



BUILDING 48 FLOOR PLAN SHOWING ADDITIONS

FIGURE 3

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1984 ESTIMATES

PROJECT TITLE:	Modifications to Mobile Launch Platform #3
INSTALLATION:	John F. Kennedy Space Center
FY 1984 CoF ESTIMATE:	$27,300,000

LOCATION OF PROJECT: John F. Kennedy Space Center, Brevard County, Florida

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1983 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	1,000,000	---	1,000,000
Capitalized investment	N/A	14,328,737	14,328,737
Total	1,000,000	14,328,737	15,328,737

SUMMARY PURPOSE AND SCOPE:

The Space Shuttle Program has made maximum use of reconfigured equipment and modified facilities from the Apollo Program to reduce capital costs. By using such equipment and facilities the Shuttle is mated, integrated, checked out, moved to the launch pad, and launched from mobile launch platforms (MLP) that have been modified for Shuttle use from the Apollo configuration (Figure 1). Prior years' resources provided for modifications to two Apollo mobile launchers for this purpose. Reconfiguring a third MLP for Shuttle is required now to support flights manifested in 1986 and beyond. The launch capability is currently limited to approximately 16 flights per year, using the two MLP's.

PROJECT JUSTIFICATION:

Earlier estimates indicated that each modified MLP would ultimately support 15 to 16 Shuttle launches per year. Experience from the four developmental flights and the first operational flight has shown these original estimates to be overly optimistic. Although the MLP processing time between launches has decreased and should continue to decrease with each flight, the ultimate launch rate per MLP appears to be 8 flights per year. Based on these projections, planned launch rates for the fourth quarter of 1986 and beyond will exceed the capabilities of the first two mobile launchers. Because modifications to provide the third mobile launcher require approximately 3 years, this project is included in the FY 1984 budget request.

IMPACT OF DELAY:

Delaying this project will have an adverse impact on the flight schedule for FY 1987 and subsequent years. Until this third MLP becomes operational, the launch rate will be limited to 16 flights per year.

PROJECT DESCRIPTION:

This project provides for modifications to an existing Apollo era mobile launch platform and provides utilities to test the reconfigured MLP at its park site. Modifications to the mobile launcher include relocating vehicle support and hold-down points; reconfiguring engine exhaust openings; and modifying/installing electrical, mechanical, communications, and special systems. They are virtually the same as accomplished for the two previously modified MLP's.

The MLP, which was originally designed and constructed to accommodate Apollo hardware, is a two-story steel structure, 25 feet high by 160 feet long by 136 feet wide (7.6 meters by 48.8 meters by 41.5 meters). An umbilical tower rises 380 feet (115.8 meters) above the deck of the launch platform and weighs approximately 10.5 million pounds (4.76 million kilograms). A launch pedestal weighing approximately 1 million pounds (0.45 million kilograms), used for launching a Saturn 1B with a Skylab payload, rises 127 feet (38.7 meters) above the launch deck. Electric power; gaseous nitrogen and helium; a deluge system; heating, ventilating, and air-conditioning (HVAC); and a fire extinguishing system are part of the platform. Much of the piping and cabling is contained inside the platform. Propellant lines for liquid hydrogen run outside the platform to the spacecraft. To adapt this large and complex facility to Shuttle requirements, major modifications are required.

The MLP modifications include providing three openings in the mobile launcher--one approximately 32 feet by 35 feet (9.8 meters by 10.7 meters) for the Orbiter main engine exhaust and two approximately 20 feet by 42 feet (6.1 meters by 12.8 meters) for the Solid Rocket Booster (SRB)--instead of the one opening of the Apollo configuration. Girders, framing, deck plates, heat shields, and hold-down arms will be removed. Piping for

the HVAC system; ducts for the environmental control system; and lines for the pneumatic, propellant, water, and coolant systems will be rerouted to accommodate the new exhaust openings. Instrumentation, communications lines, controls, 60-Hertz power, lighting, and the lightning protection system all must be modified. A new fire alarm system and a hazardous gas detection system will be provided.

New support and hold-down points for the SRB and new support points for the removable Orbiter erection supports will be provided. Crawler transporter/mobile launcher support points will be relocated to balance the load. These reconfigurations will require modifications to the internal structure of the launcher as well as rerouting mechanical and electrical systems.

The umbilical towers on the previously modified mobile launchers were removed as part of the CoF modifications because they were required for use at Pad A and Pad B. The umbilical tower and launch pedestal on this third mobile launcher are not required for the Shuttle Program. Therefore, they are being excessed and are not included in this CoF project.

PROJECT COST ESTIMATE:

This cost estimate is based on related engineering studies and experience gained in modifying MLP's 1 and 2.

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition	---	---	---	---
Construction	---	---	---	27,300,000
Mobile Launch Platform	---	---	---	25; 100,000
Removal of tower/adapter	LS	---	---	(374,000)
Structural	LS	---	---	(15,464,000)
Mechanical	LS	---	---	(7,240,000)
Electrical	LS	---	---	(1,300,000)
Water systems	LS	---	---	(722,000)
MLP park/maintenance site utilities	LS	---	---	2,200,000
Equipment	---	---	---	---
Fallout Shelter (not feasible)	---	---	---	---
Total				27,300,000

LIST OF RELATED GRAPHICS:

Figure 1 - Schematic

OTHER EQUIPMENT SUMMARY:

Certain items of noncollateral equipment will be required to make MLP-3 operational. These include the tail service masts, pneumatic panels for gaseous nitrogen and helium, and Launch Processing System equipment. These items will cost approximately $42,300,000 (nonrecurring) and will be provided with R&D resources.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No future CoF funding for this third MLP is anticipated.

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1984 ESTIMATES
MODIFICATIONS TO MOBILE LAUNCH PLATFORM #3

SCHEMATIC

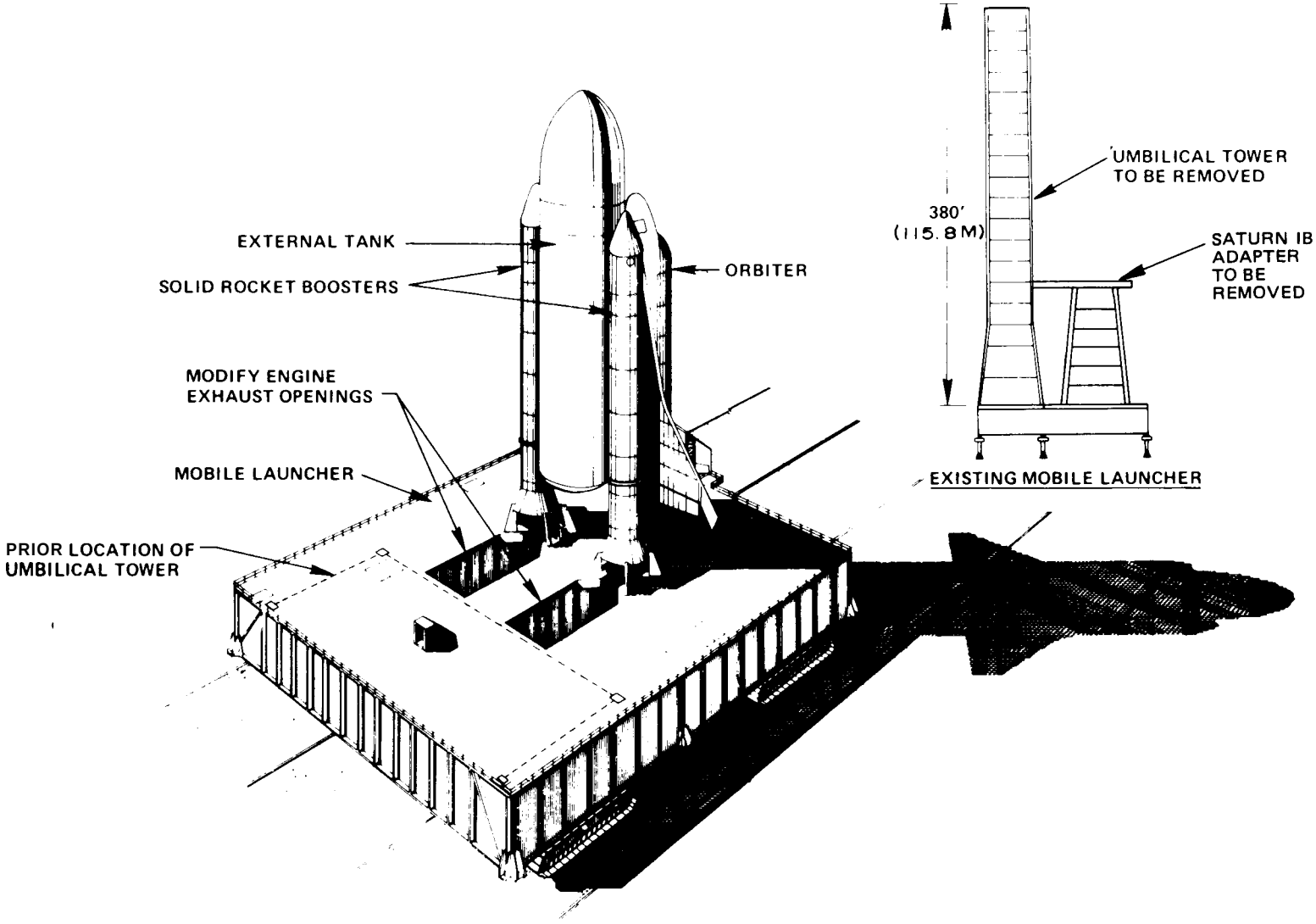
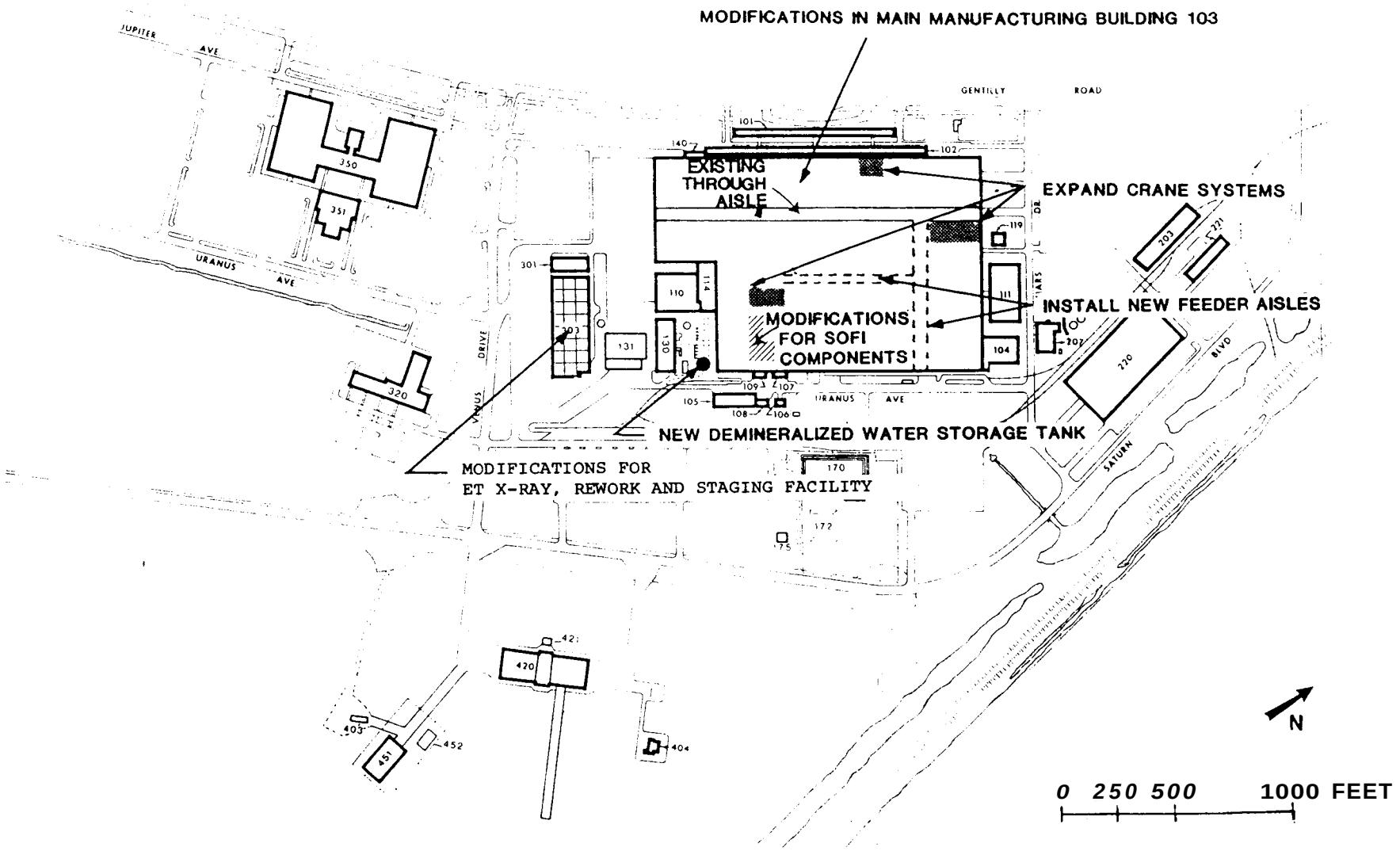


FIGURE 1

MICHOUD ASSEMBLY FACILITY
FISCAL YEAR 1984 ESTIMATES
MODIFICATION OF MANUFACTURING AND FINAL ASSEMBLY FACILITIES FOR EXTERNAL TANKS

LOCATION PLAN



CF 1-18

FIGURE 1

PROJECT TITLE: Modifications of Manufacturing and Final Assembly Facilities for External Tanks

INSTALLATION: Michoud Assembly Facility

FY 1984 CoF ESTIMATE: $11,700,000

LOCATION OF PROJECT: New Orleans, Orleans Parish, Louisiana

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1983 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	6,600,000	46,910,000	53,510,000
Capitalized investment	N/A	144,515,000	144,515,000
Total	6,600,000	191,425,000	198,025,000

SUMMARY PURPOSE AND SCOPE:

This project continues work funded in Fiscal Year 1983 and prior years for modifications of manufacturing and final assembly facilities at the Michoud Assembly Facility (MAF) for Space Shuttle External Tank (ET) production. The ET is the component of the Space Shuttle that supplies propellants to the Orbiter's main engines. Each ET consists of three major components: a liquid oxygen (LO_2) tank, an intertank, and a liquid hydrogen (LH_2) tank. The facility modifications at MAF are required to provide capability for fabrication and

assembly, testing and cleaning, application of a thermal protection system (TPS), and major component assembly of the ET. The tank also must be equipped with plumbing and electrical systems, and then checked/accepted prior to shipment to the launch site for mating with the Orbiter and Solid Rocket Boosters.

Prior years resources provided phased modifications to the Main Manufacturing Building 103; the Vertical Assembly Building (VAB) 110; and the Final Acceptance and Checkout Building, Building 420. Also included were construction of a High Bay Addition, Building 114; a facility to apply TPS coating to the LO_2 tank and the intertank; a facility for cleaning, priming, and applying ablator to the LH_2 tank, Building 131; and a pneumatic proof-test facility for the LH_2 tank, Building 451.

This project continues the modifications required to support an ET production rate of 24 per year. The work includes modifications in the Main Manufacturing Building 103 to optimize the production flow by providing two feeder aisles, additional crane coverage and increased spray-on foam insulation (SOFI) component machine and spray capacity; modifications to Building 303 to provide an ET X-ray, Rework and Staging Facility; and to expand the demineralized water storage capacity (Figure 1).

PROJECT JUSTIFICATION:

Modifications in Main Manufacturing Building 103

Modifications for Production Flow. A major east/west 45-foot (13.7 meter) wide aisle through the entire length of the plant to alleviate material and component crossflow and backflow congestion, and aisle blockage in the major weld and subassembly areas was provided with prior year resources. Continuing these flow improvements, this project provides a 35-foot (10.7 meter) wide north/south feeder aisle to permit efficient flow of large crated components on dollies from the receiving/inspection area to the production control areas. This aisle also will be used for the transport of the intertanks and support tool fabrication operations. An additional east/west 24-foot (7.3 meter) wide aisle also is required for traffic flow of maintenance personnel and equipment, vendors, and other nonproduction activities south of the major production flow aisle to minimize interference between major component flows and support activities. The overhead crane systems will also be expanded in the ogive production control area, the LH_2 Barrel mechanical installation and storage area, and the dome mechanical installation and storage area. The feeder aisles and expanded crane coverage are required to attain a production rate of 24 ET's per year. Also, these modifications achieve receiving, transportation, and handling costs avoidance.

SOFI Components Facility Modifications. To support a production rate of 24 ET's per year, it is also necessary to expand the SOFI spray and machining area. To prevent ice/debris on the aft interface hardware during launch, an additional 44 components such-as thrust struts, umbilical cable trays, and LO_2 feedline

supports must receive the SOFI application. These components were previously coated only with ablator material. Accordingly, the existing SOFI area must be expanded to accommodate large cable trays, struts, and crossbeams which previously did not require SOFI application and machining, and to increase production capability from 18 to 24 ET's per year.

Modifications for ET X-Ray, Rework and Staging Facility. This project modifies Hangar Building 303 for post-proof X-ray of the LO_2 and LH_2 tank welds and provides a staging and rework area for completed and partially completed tanks. Now the LO_2 and LH_2 tanks are assembled and X-rayed in the Main Manufacturing Building 103. They are then moved to another building for proof tests (leak checks); moved back to Building 103 for post-proof test X-ray; and then moved a second time out of Building 103 to be cleaned, covered with TPS, and then mated into a completed ET. The movement of the LO_2 and LH tanks in and out of Building 103 for post-proof test X-ray adversely affects the manufacturing production flow. To alleviate this problem, the post-proof X-ray function will be relocated from Building 103 to Building 303. The staging and rework areas are needed for off-line ET and component tank rework and/or modification, queuing of LO_2 and LH_2 tanks which are to be cleaned and/or have TPS applied, and for temporary storage of completed ET's awaiting shipment to a launch site.

Demineralized Water Storage Tank. The demineralized water system which is used for cleaning the LO_2 tank in Cell E and the LH_2 tank in Cell P, the LO_2 tank hydrostatic test in Cell F, and the major component and chemical cleaning operations in Building 103 can only support approximately 18 ET's per year. For higher rates, it is necessary to install a 500,000-gallon (1,892,650 liter) water tank with cross connects to the existing system. This will accommodate tank cleaning operations for 24 ET's per year while allowing for continuous use of demineralized water in Building 103.

IMPACT OF DELAY:

A delay in this project will prevent attainment of a production rate of 24 ET's per year. The overall plant layout for ET production will remain inefficient without the feeder aisles and additional crane coverage in the Main Manufacturing Building 103. The SOFI spray and machining functions are limited to 18 ET's per year and cannot readily accommodate the larger size components. Without the ET X-ray, staging and rework facility, ET production will not attain a production rate of 24 per year in the Main Manufacturing Building 103 because of the disruption resulting from the movement of the tanks back into Building 103 for post-proof X-ray and the lack of rework, staging and queuing space. The existing demineralized water system capacity is also limited to 18 ET's per year. In summary, without this project the ET's cannot be fabricated at a rate sufficient to support the Space Transportation System mission model.

PROJECT DESCRIPTION:

Modifications in Main Manufacturing Building 103

Modifications for Production Flow. Two feeder aisles will be provided in the southern portion of Building 103 (Figure 2). A 35-foot (10.7 meter) wide, north/south aisle will provide access between the receiving/inspection area to the production area. The second aisle will be a 24-foot (7.3 meter) east/west aisle south of the main through-aisle. Crane systems (5- and 10-ton) will be provided to support the LH_2 barrel mechanical installation and storage and the dome mechanical installation and storage area. A 3-ton crane system will also be installed in the ogive production control area for component uncrating and movement. The establishment of the aisles includes clearing of obstructions, relocating utilities, offices, fences, and structures, and repairing the floor.

SOFI Components Facility Modifications. The work includes modifying approximately 20,000 square feet (1,858 square meters) of area formerly occupied by the ablator application and machining operations (Figure 2). The entire area will be cleaned to remove all-contaminating ablator traces. Partitions will be relocated and the spray room will be enlarged. A dust collection system, a monorail system, and explosion-proof fixtures will be installed and the air-handling system will be modified and balanced to insure negative pressures and required air changes.

Modifications for ET X-Ray, Rework and Staging Facility. This provides for replacement of the concrete floor with pile-supported foundation for the X-ray position tooling, ET transporter, and the transporter jack points (Figure 3). The door sill will be modified to allow unimpeded passage and the doors will be repaired or replaced to allow access into the building. Structural modifications will be made to a section of an interior wall to accommodate the full length of the tank. Bridge cranes will be installed and trusses will be strengthened as necessary. Factory-type lighting and air-conditioning, plant air, gaseous nitrogen (GN), and other required utilities will be installed. Repair of damaged concrete roof slabs and replacment of 80,600 square feet (7,432 square meters) of insulation and roofing is also included.

Demineralized Water Storage Tank. A new 500,000-gallon (1,892,650 liter) tank (Figure 4) to receive demineralized water output from the Industrial Waste Water Treatment Facility and the Demineralized Water Treatment Plant will be erected. The storage tank discharge will be connected to the existing demineralized water system to support wash activities in Cells E and P, the proof-test activities in Cell F, and cleaning needs in Building 103. Controls and valving, necessary for automatic/manual operations, level indicators, a recirculation system, pH conductivity and similar sensors necessary for continuous systems checks will also be installed.

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition	---	---	---	---
Construction	---	---	---	11,700,000
Modifications in main manufacturing building 103	---	---	---	3,850,000
Production flow				
Aisles	LS	---	---	(460,000)
Cranes	LS	---	---	(1,890,000)
SOFI components	LS	---	---	(1,500,000)
Modifications for ET X-ray, staging & rework facility	---	---	---	5,850,000
Architectural/structural	LS	---	---	(3,185,000)
Mechanical	LS	---	---	(1,500,000)
Electrical	LS	---	---	(635,000)
Roof repair	LS	---	---	(530,000)
Demineralized water storage tank	---	---	---	2,000,000
Architectural/structural	LS	---	---	(606,800)
Mechanical	LS	---	---	(1,071,800)
Electrical	LS	---	---	(321,400)
Equipment	---	---	---	---
Fallout ,Shelter (not feasible)	---	---	---	---
Total				11,700,000

LIST OF RELATED GRAPHICS:

Figure 1 - MAF Location Plan
Figure 2 - Modifications in Main Manufacturing Building 103
Figure 3 - Modifications for ET X-Ray, Rework and Staging Facility
Figure 4 - Demineralized Water Storage Tank

OTHER EQUIPMENT SUMMARY:

Special tooling (e.g., spray tooling, assembly tooling, unique work platforms, and special dollies) required for ET manufacturing operations will be funded from approximately $8.2M of R&D resources.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

CoF resources may be required in the future to provide for additional production related facilities to support increased production rates.

MICHOUD ASSEMBLY FACILITY
FISCAL YEAR 1984 ESTIMATES
MODIFICATION OF MANUFACTURING AND FINAL ASSEMBLY FACILITIES FOR EXTERNAL TANKS

MODIFICATIONS IN MAIN MANUFACTURING BUILDING 103

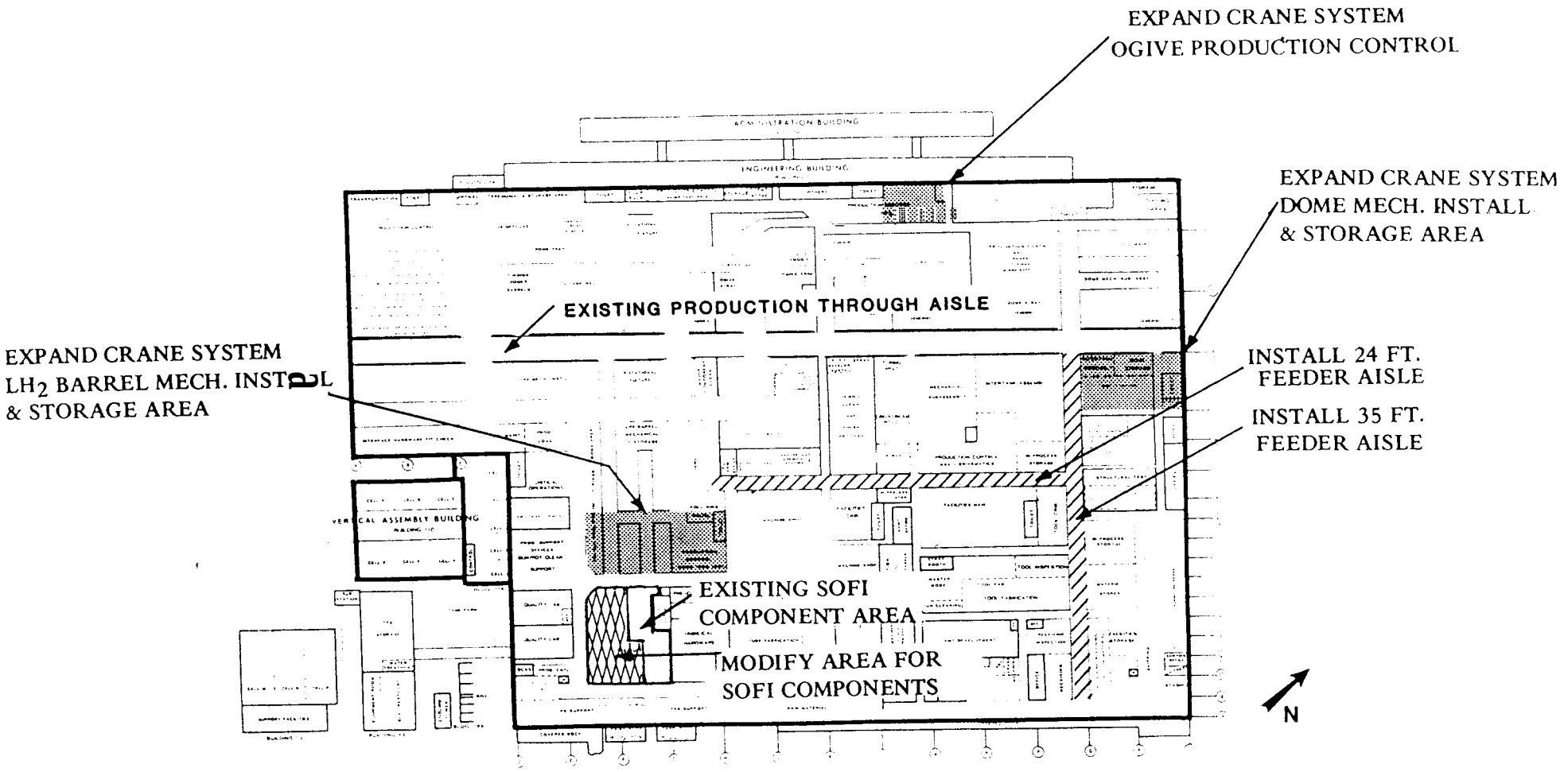


FIGURE 2

MICHOUD ASSEMBLY FACILITY
FISCAL YEAR 1984 ESTIMATES
MODIFICATION OF MANUFACTURING AND FINAL ASSEMBLY FACILITIES FOR EXTERNAL TANKS

MODIFICATIONS FOR ET X-RAY, REWORK AND STAGING FACILITY

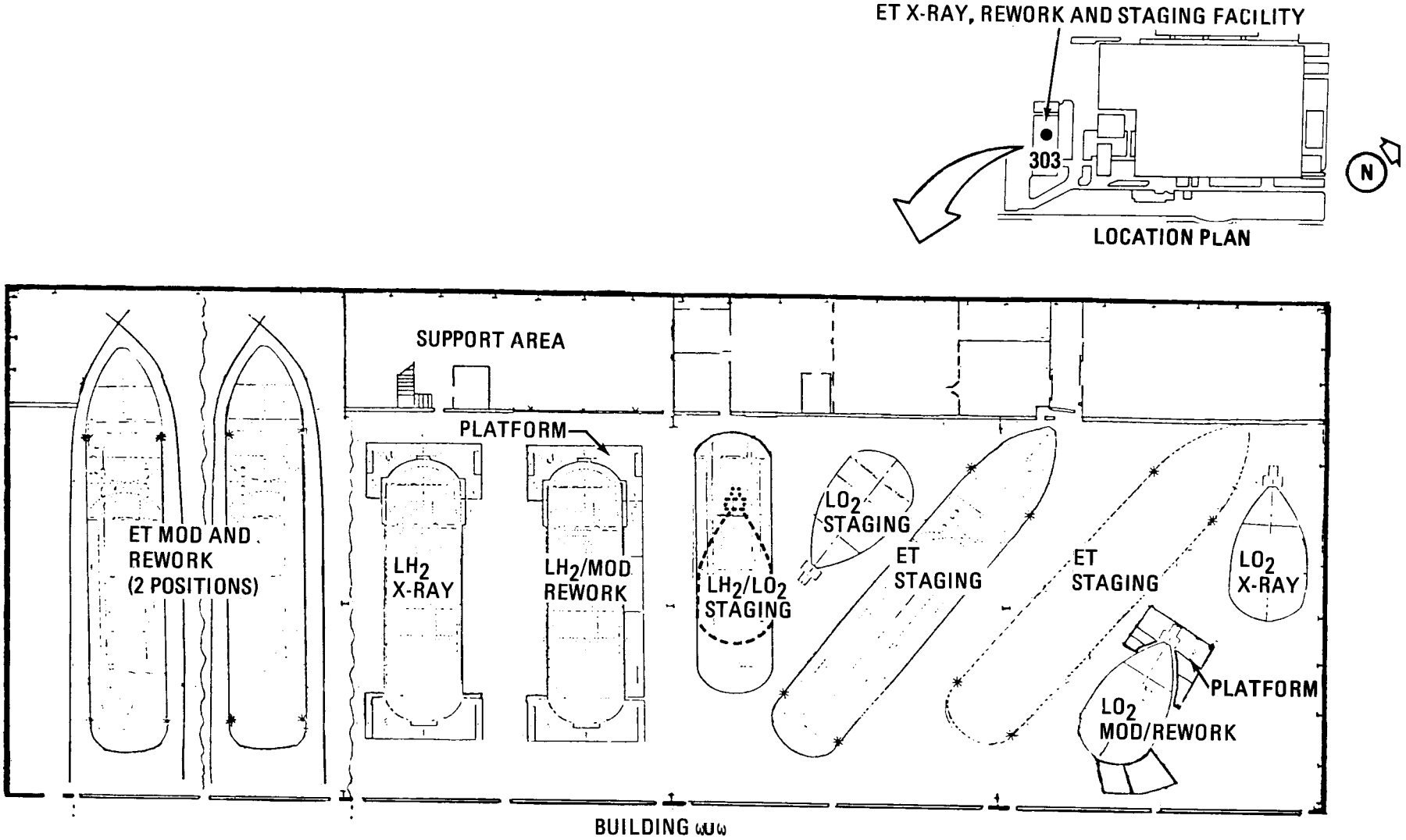
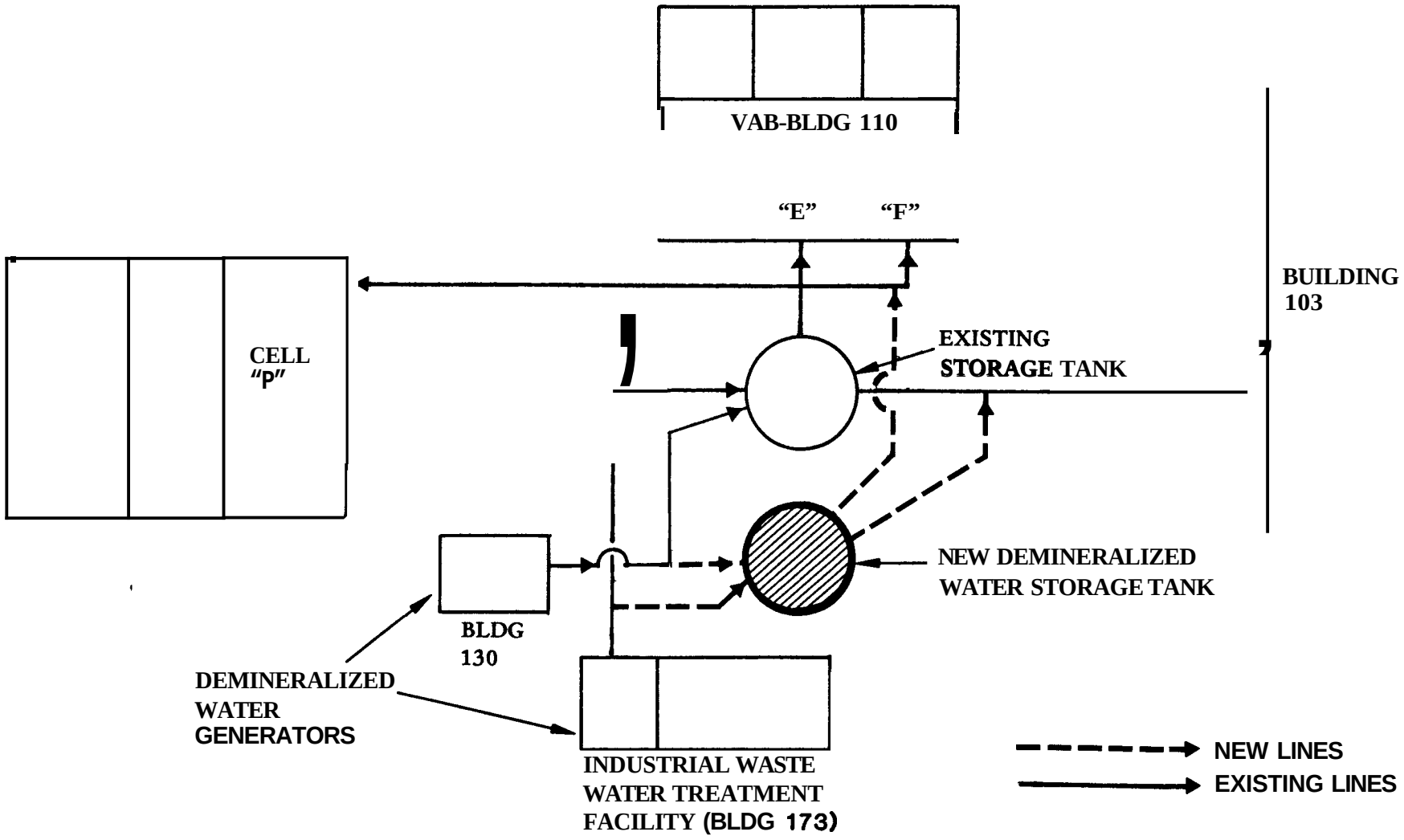


FIGURE 3

MICHOUD ASSEMBLY FACILITY
FISCAL YEAR 1984 ESTIMATES
MODIFICATION OF MANUFACTURING AND FINAL ASSEMBLY FACILITIES FOR EXTERNAL TANKS

DEMINERALIZED WATER STORAGE FACILITY



DEMINERALIZED WATER FLOW

FIGURE 4

SPACE SHUTTLE
PAYLOAD
FACILITIES

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1984 ESTIMATES

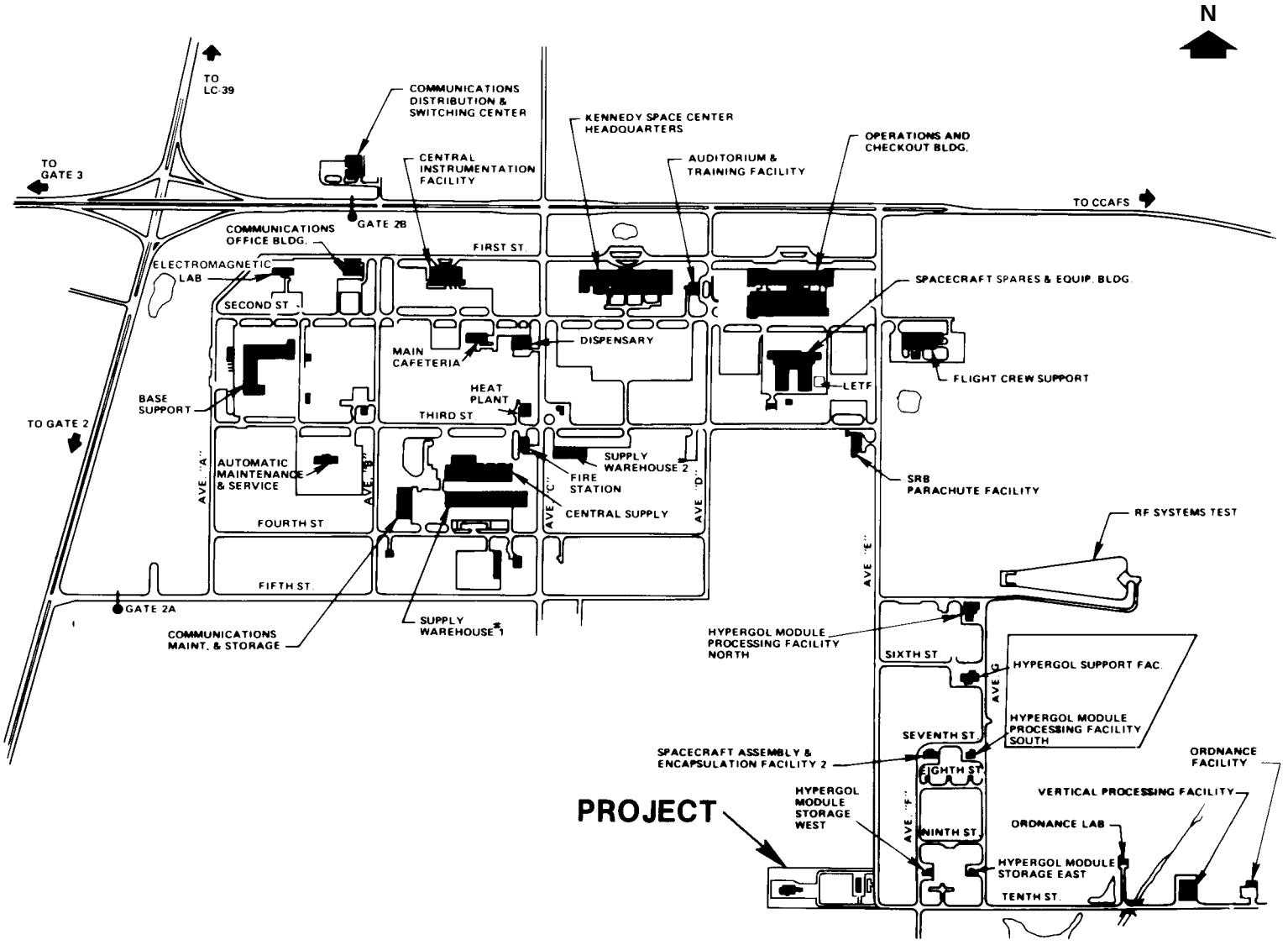
SUMMARY

SPACE SHUTTLE PAYLOAD FACILITIES

Office of Space Flight:	Amount	Page No.
Construction of Cargo Hazardous Servicing Facility Kennedy Space Center	9,000,000	CF 2-1
Modifications to Spacecraft Assembly and Encapsulation Facility (SAEF-2) for Cargo Processing Kennedy Space Center	3,000,000	CF 2-9
Total	12,000,000	

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1984 ESTIMATES
CONSTRUCTION OF CARGO HAZARDOUS SERVICING FACILITY

LOCATION PLAN



KENNEDY SPACE CENTER INDUSTRIAL AREA
FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1984 ESTIMATES

PROJECT TITLE:	Construction of Cargo Hazardous Servicing Facility
INSTALLATION:	John F. Kennedy Space Center
FY 1984 CoF ESTIMATE:	$9,000,000

LOCATION OF PROJECT: John F. Kennedy Space Center, Brevard County, Florida

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1983 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	720,000	---	720,000
Capitalized investment	N/A	---	---
Total	720,000	---	720,000

SUMMARY PURPOSE AND SCOPE:

This project provides for construction of a facility in the KSC Industrial Complex (Figure 1) for cargo hazardous servicing in support of the Space Transportation System (STS). This facility (Figure 2) will provide the capability to adequately process and safely load propellants and explosive ordnance into the largest vertical class payloads that can fit in the STS Orbiter cargo bay. It will consist of an environmentally-controlled payload servicing cell (Figure 3) equipped with dual cranes and will provide required servicing capability for the increasing numbers of large STS payloads.

PROJECT JUSTIFICATION:

There is a requirement to process large vertical class payloads which must have hypergol propellant loaded and drained, various ordnance systems installed and other servicing/test/checkout conducted prior to being launched with the Space Shuttle. Various processing options using facilities now available have been considered and discarded. Use of the rotating service structure at the launch pad would be hampered by limited access, numerous personnel hazards, potential Orbiter damage, and severe adverse impact on launch processing schedules.

The Delta Spin Test Facility cannot accommodate the larger payloads and is primarily dedicated to Spinning Solid Upper Stage processing. The two Explosive Safe Area (ESA-60) cells also cannot accommodate the larger payloads. The Vertical Processing Facility (VPF) is dedicated and fully scheduled for payload integration activities. The VPF does not have hypergol fuel loading and draining capability, and is so heavily scheduled now that even with appropriate modifications, use for these processing needs would cause costly payload integration delays. Finally, the Spacecraft Assembly and Encapsulation Facility #2 (SAEF-2), which is being modified to handle large vertical class payloads by another project in this FY 1984 CoF Budget request, will be capable of processing this type cargo. But, the SAEF-2 facility is also very heavily scheduled for processing payloads that will require extensive processing and checkout times. Some of these payloads and processing times are: the Long Duration Exposure Facility, 3 months; Hughes Spin-Stablized Spacecraft (SYNCOM-IV), 2 months; and Planetary Orbiter/Probe, 5-6 months.

In summary, existing and presently planned payload processing capability is inadequate in size and capability to provide for the large vertical class payloads that must be prepared for launch on the Shuttle at KSC. A new facility which provides the additional processing capacity is needed, and it is required to be operational by October 1985 to support the present flight cargo manifests. To increase the efficiency of processing large vertical payloads, this proposed facility must be large enough to accommodate the multiuse mission support equipment transporter and canister.

IMPACT OF DELAY:

Delay of this project will prevent KSC from adequately and efficiently processing and servicing the very large vertical payloads planned for future STS flights.

PROJECT DESCRIPTION:

The approximately 9,900-square foot (920 square meter) air-conditioned building to be constructed with these resources will consist of a servicing cell and support area. The servicing cell will be 60 feet wide by 110 feet long (18.3 meters by 33.5 meters), and will be equipped with dual 50-ton (5,000 kilograms) bridge cranes with an 85-foot (26 meter) hook height. The building will be designed and constructed to provide a class 100,000 clean room atmosphere for cargo operations. A door approximately 35 feet wide by 75 feet high (10.1 meters by 23 meters) will be provided to accommodate the cargo canister in a vertical position on its transporter. The support area consists of an equipment airlock approximately 300 square feet (28 square meters) in size at the side of the building which will be used for transferring ground support equipment (GSE) into and out of the servicing cell. In addition, approximately 3,000 square feet (279 square meters) of low bay area will be provided to house mechanical and electrical equipment, a security station, and personnel locker rooms.

The servicing cell floor will have a finish suitable for air bearing pallets for moving cargoes. An 80- by 80-foot (24.4 by 24.4 meter) concrete pad will be constructed at the entrance to the servicing facility for air bearing pallet and canister/transporter operations exterior to the cell.

PROJECT COST ESTIMATE:

This cost estimate is based on in-house estimates and related construction costs indexes.

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition	---	---	---	---
Construction	---	---	---	9,000,000
Site work	LS	---	---	1,410,000
Building	SF	9,894	399.84	3,956,000
Mechanical	LS	---	---	1,760,000
Electrical	LS	---	---	795,000
Cranes	EA	2	539,500	1,079,000
Equipment	---	---	---	---
Fallout Shelter (not feasible)	---	---	---	---
Total				9,000,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Site Plan
Figure 3 - Perspective

OTHER EQUIPMENT SUMMARY:

Certain items of noncollateral equipment will be required, such as scrubbers, aspirators, antennas, helium tank trailer, and other related equipment. The noncollateral equipment will cost approximately $370,000 and will be funded from R&D resources.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

A project estimated to cost $7,000,000 to provide an environmentally-controlled airlock attached to the service cell and a separate operations control building will be considered in the development of the FY 1985 CoF Budget request.

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1984 ESTIMATES
CONSTRUCTION OF CARGO HAZARDOUS SERVICING FACILITY

SITE PLAN

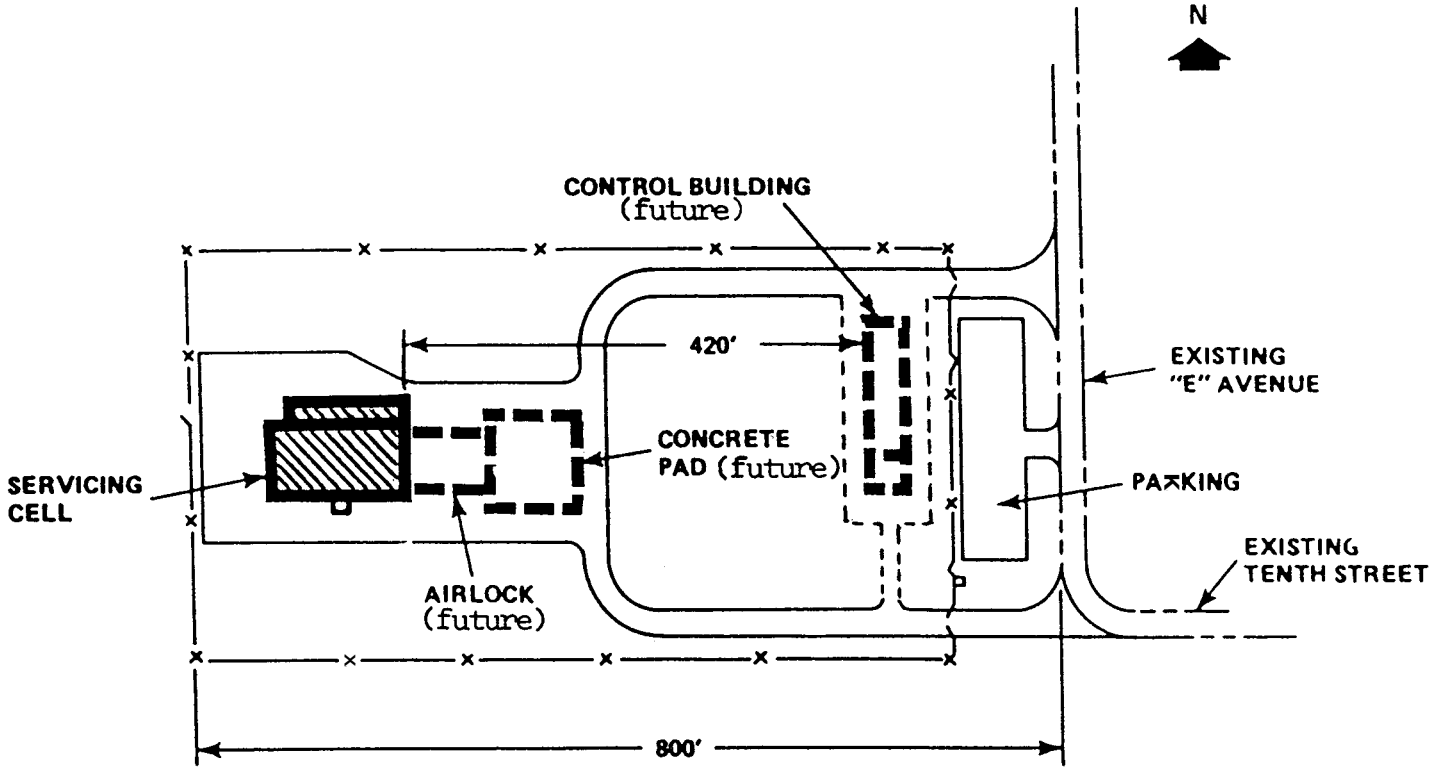


FIGURE 2

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1984 ESTIMATES
CONSTRUCTION OF CARGO HAZARDOUS SERVICING FACILITY

PERSPECTIVE

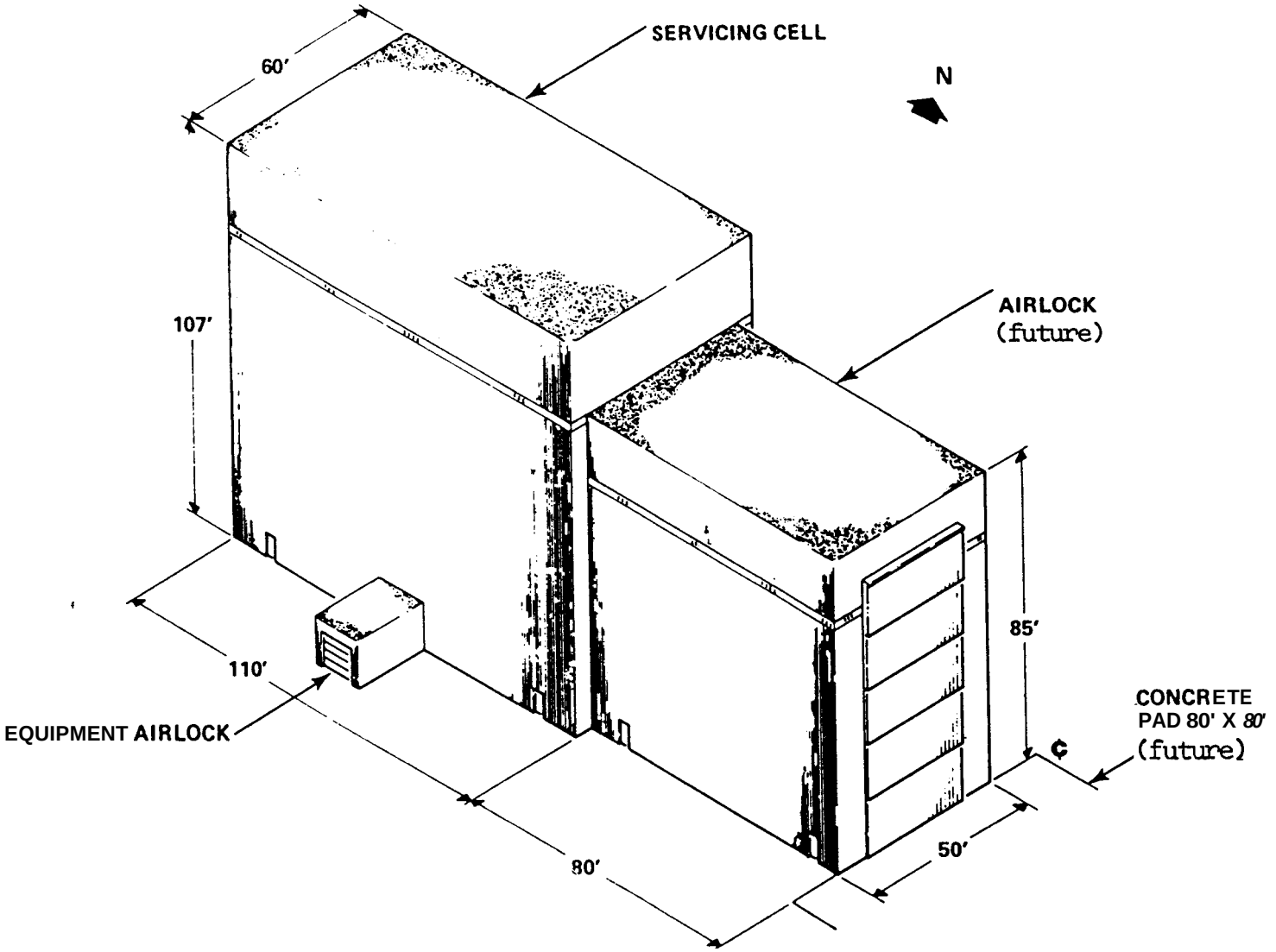


FIGURE 3

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1984 ESTIMATES
MODIFICATIONS TO SPACECRAFT ASSEMBLY AND ENCAPSULATION FACILITY (SAEF-2)
FOR CARGO PROCESSING

CF 2-9

LOCATION PLAN

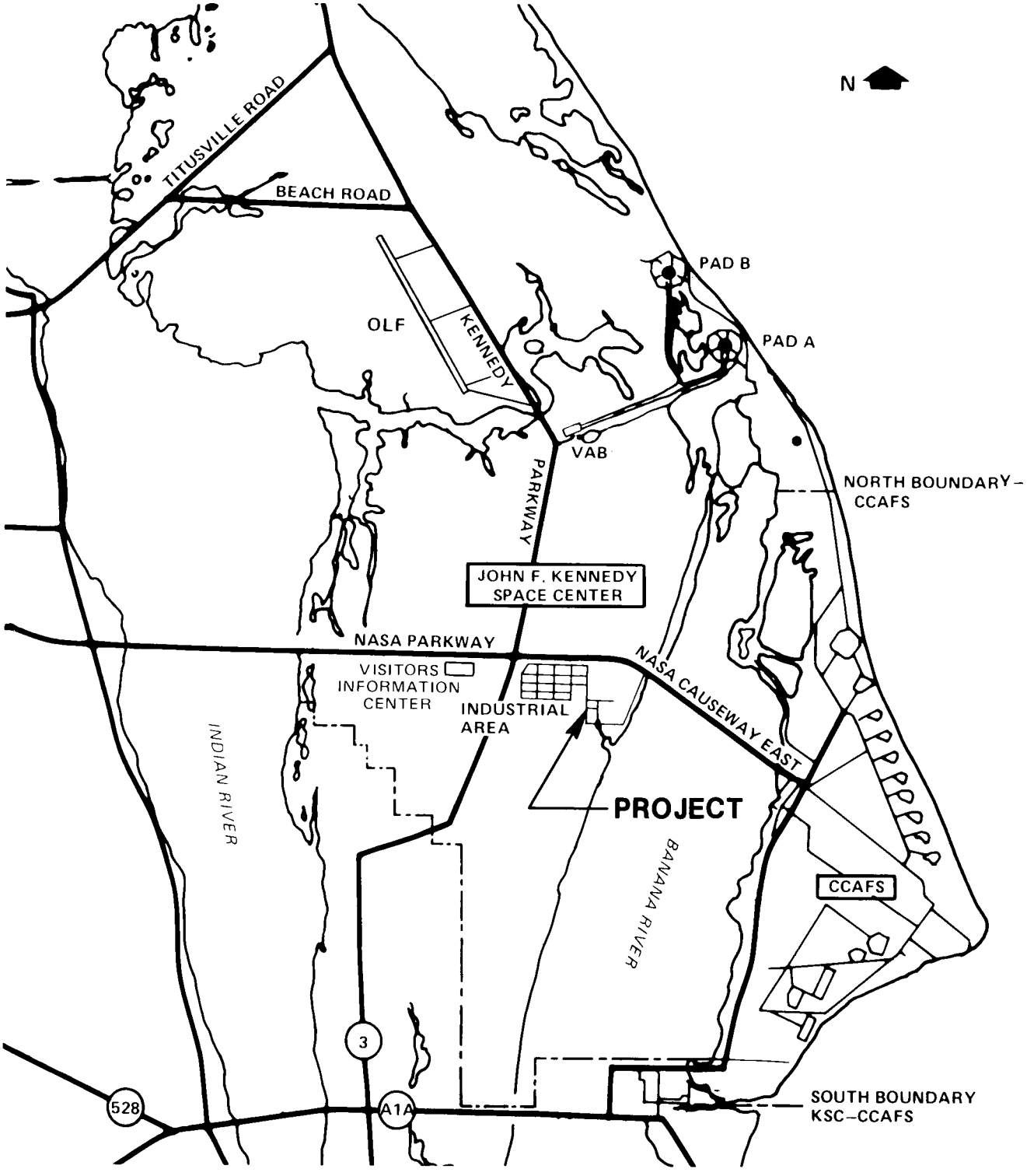


FIGURE 1

PROJECT TITLE: Modifications to Spacecraft Assembly and Encapsulation Facility (SAEF-2) for Cargo Processing

INSTALLATION: John F. Kennedy Space Center

FY 1984 CoF ESTIMATE: $3,000,000

LOCATION OF PROJECT: John F. Kennedy Space Center, Brevard County, Florida

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1983 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	237,500	---	237,500
Capitalized investment	N/A	4,505,747	4,505,747
Total	237,500	4,505,747	4,743,247

SUMMARY PURPOSE AND SCOPE:

There is no existing cargo processing capability at Kennedy Space Center (KSC) for hazardous servicing of the larger, bulkier payloads currently manifested on the Space Shuttle. This project modifies the Spacecraft Assembly and Encapsulation Facility (SAEF-2), Building M7-1210 (Figures 2 and 3), to provide the necessary servicing and lift capability for Shuttle payloads weighing more than 10 tons (9,071 kilograms). The modifications will permit the hazardous servicing of single Shuttle payloads approximately the full size of the Orbiter payload bay. This project also includes the installation of a water deluge system for fire protection within SAEF-2 and modifications to the KSC industrial area water supply system to provide the

necessary water pressure and volume for the fire protection deluge system and to support increased water requirements for fire protection of five other industrial facilities located in that immediate vicinity.

PROJECT JUSTIFICATION:

These modifications are required to provide a Shuttle payload processing capability for hypergol propellant loading and draining, ordnance system installation, and spacecraft test, checkout, and servicing. Some Shuttle manifested payloads are too large (size and/or weight) to be accommodated in the existing Delta Spin Test Facility or the Explosive Safe Area at Cape Canaveral Air Force Station. SAEF-2 has the overall space necessary to handle payloads which approach the maximum Orbiter payload bay dimensions, but there are scheduled payloads which the existing SAEF-2 cranes cannot lift for processing/servicing. Replacement of the existing 10-ton (9,071 kilogram) crane in SAEF-2 with a 20-ton (18,143 kilogram) capacity crane is required for heavy Shuttle payload processing such as the 33,174 pounds (15,047 kilograms), INTELSAT VI, now scheduled for STS-38.

In addition, SAEF-2 does not currently comply with established safety criteria for hazardous processing making facility modifications required to meet these essential operating safety standards. Temporary safety waivers, now in effect for use of SAEF-2 as a hazardous processing facility, will not be required upon the completion of this project. The water supply system in the KSC industrial area is inadequate to support the water deluge fire suppression system required as a part of these modifications. Recent analyses have revealed that there is insufficient water volume and pressure to accommodate the fire protection requirements of SAEF-2 and the needs of five other facilities which are located nearby. Therefore, it is essential that the industrial area water supply system be upgraded as a part of this project to support the demands of an emergency at SAEF-2 and the other facilities served by the system.

IMPACT OF DELAY:

This project is urgently needed to satisfy the requirement for hazardous servicing of Shuttle payloads planned for launch in 1985 and subsequent years. Servicing currently manifested payloads which exceed the existing lift capability would be extremely difficult and inefficient. STS payload manifests would have to be revised as these outsize payloads cannot be routinely processed for flight, and unacceptable operational constraints on the efficiency of the STS payload processing in CY 1985 and beyond would result.

PROJECT DESCRIPTION:

This project modifies SAEF-2 by replacing the existing 10-ton (9,071 kilogram) crane with a 20-ton (18,143 kilogram) crane, installing a water deluge system for fire suppression, an oxidizer waste tank with trench and drains for containing potential fuel spills and an emergency exhaust system with vent stacks, and hazard-

proofing the drains and exhaust system and the electrical power system. Structural modifications will be required to accommodate the installation of the 20-ton (18,143 kilogram) crane and the floor drain trenches. The KSC industrial area water supply system will be modified and upgraded as a part of this project to support the water volume and pressure requirements of the fire suppression deluge system. To satisfy the anticipated demand for water during an emergency, a separate ground level storage tank, pumping facility, and distribution system will be installed to service all facilities in the hazardous processing area. To minimize costs, two 1,000 horsepower diesel-driven pumps will be relocated from Launch Complex 39 and a 1,000,000 gallon (3,785 cubic meter) ground level storage tank will be relocated from the existing industrial area pumping station.

PROJECT COST ESTIMATE:

This cost estimate is based on a preliminary engineering report and related studies.

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition	---	---	---	---
Construction	---	---		905,000
Site development	LS	---	---	143,900
Architectural/structural	SF	16,750	8.66	145,000
Mechanical	SF	16,750	29.97	502,000
Electrical	SF	16,750	6.81	114,100
Crane Installation	---	---	---	295,000
Architectural/structural	SF	16,750	2.68	(45,000)
Crane (20-ton) and installation	LS	---	---	(220,000)
Existing crane (10-ton) removal	LS	---	---	(30,000)
Fire Protection Water Distribution System	---	---	---	1,800,000
Site development	LS	---	---	(300,000)
Utilities	LS	---	---	(158,000)
Pump station	LS	---	---	(255,000)
Distribution system	LS	---	---	(524,000)
Relocate 1,000,000 gallon storage tank	LS	---	---	(239,000)
Relocate pumps	LS	---	---	(324,000)
Equipment	---	---	---	---
Fallout Shelter (not feasible)	---	---	---	---
Total				3,000,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Site Plan
Figure 3 - Aerial Photograph of SAEF-2

OTHER EQUIPMENT SUMMARY:

Certain items of noncollateral equipment will be required to make these facilities operational. These include scrubbers, aspirators, and related equipment. The noncollateral equipment will cost approximately $300,000 and will be provided from R&D resources.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No additional funding to complete this project is anticipated.

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1984 ESTIMATES
MODIFICATIONS TO SPACECRAFT ASSEMBLY AND ENCAPSULATION FACILITY (SAEF-2)
FOR CARGO PROCESSING

SITE PLAN

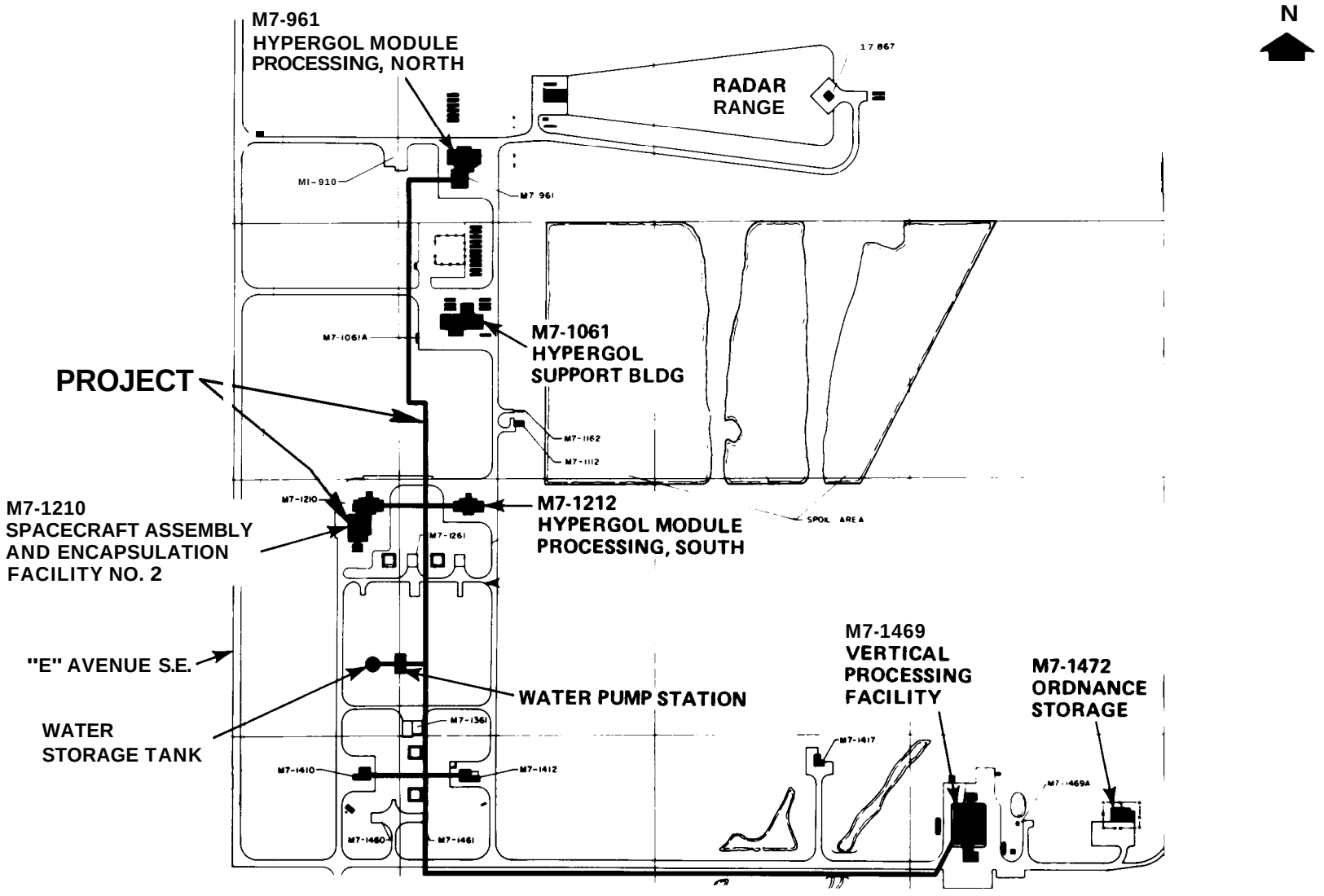


FIGURE 2

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1984 ESTIMATES
MODIFICATIONS TO SPACECRAFT ASSEMBLY AND ENCAPSULATION FACILITY (SAEF-2)
FOR CARGO PROCESSING

AERIAL PHOTOGRAPH OF SAEF-2

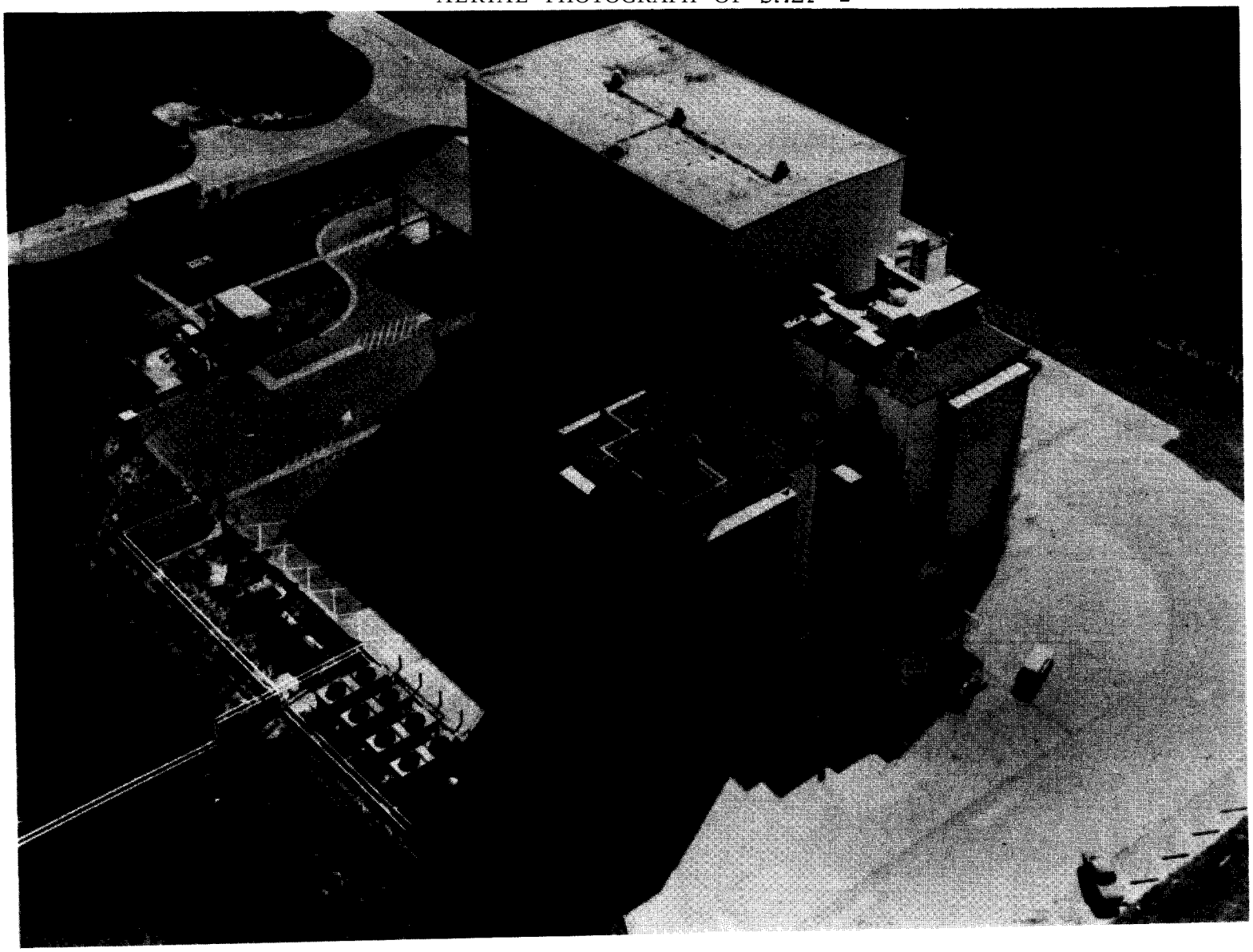


FIGURE 3

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1984 ESTIMATES

SUMMARY

JET PROPULSION LABORATORY

	Amount	Page No.
Office of Space Tracking and Data Systems:		
Construction of Frequency Standards Laboratory	2,700,000	CF 3-1
Modifications to Space Flight Operations Facility	1,600,000	CF 3-7
Total	4,300,000	

JET PROPULSION LABORATORY
FISCAL YEAR 1984 ESTIMATES
CONSTRUCTION OF FREQUENCY STANDARDS LABORATORY

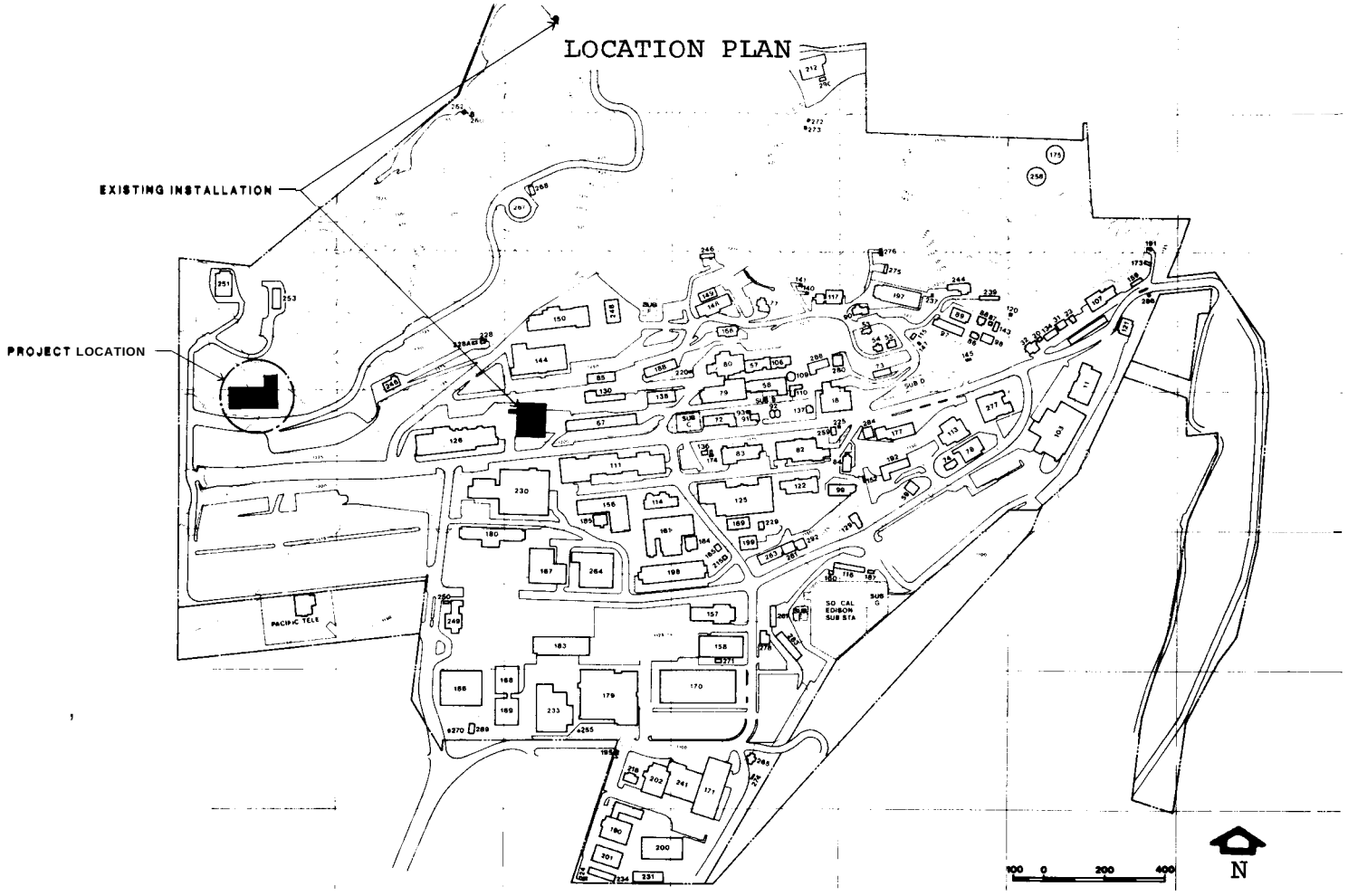


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1984 ESTIMATES

PROJECT TITLE: Construction of Frequency Standards Laboratory

INSTALLATION: Jet Propulsion Laboratory

FY 1984 CoF ESTIMATE: $2,700,000

LOCATION OF PROJECT: La Canada-Flintridge, Los Angeles County, California

COGNIZANT HEADQUARTERS OFFICE: Office of Space Tracking and Data Systems

FY 1983 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	230,000	---	230,000
Capitalized investment	N/A	---	---
Total	230,000	---	230,000

SUMMARY PURPOSE AND SCOPE:

This project provides for the construction of a Frequency Standards Laboratory at the Jet Propulsion Laboratory (JPL). This facility is required to provide vital on-line operational support for hydrogen maser timing devices used in the Deep Space Network (DSN). Hydrogen masers are precision timing references required for planetary spacecraft navigation and science measurements. A higher level of precision of these operational DSN masers is required, and this project will provide the needed laboratory facility that is essential to fulfill this need.

PROJECT JUSTIFICATION:

Hydrogen masers are being used as the primary timing references for the DSN. These precision timing devices are the navigational references for calculating spacecraft positions for flight trajectory determinations and navigational sequencing. They are also the basis for precision science measurements. Hydrogen masers are extremely accurate, but are also extremely sensitive to environmental disturbances. Proper calibration is a time-consuming and rigorous procedure, requiring sustained maser operation in a stringently controlled environment. Recalibration must be accomplished each time a maser undergoes a major repair.

The present makeshift calibration facility at JPL was only marginally adequate when developed for testing the few early DSN masers. Its single test chamber lacks sufficient testing capacity and cannot be environmentally controlled to the extent required for proper calibration of the more advanced DSN masers of today or any future improved timing devices. Without a stable laboratory test environment for determining maser operating characteristics, maser performance cannot be adequately predicted for long-term service in the DSN.

Present timing systems can achieve a 10^{-14} frequency stability. However, there is a pressing requirement for masers with 10^{-16} or better stability for spacecraft missions, especially for the advanced Very Long Baseline Interferometry (VLBI) navigation systems requirements of the Galileo missions. Science experiments such as gravity wave detection require 10^{-17} or better stability. The limitations of the present facilities preclude calibration measurements at this higher stability level.

The new laboratory facility will provide test areas with the required precisely controlled, disturbance free conditions, and sufficient capacity for long-term hydrogen maser calibration testing. The DSN timing systems activities at JPL will be consolidated into the new facility from three separate, inadequate areas for improved operations. This facility must be operational in 1985 to provide essential maser support to the DSN, especially for the Galileo mission.

IMPACT OF DELAY:

Delay in providing this facility would result in inadequate on-line operational support of the critical DSN hydrogen maser timing systems. The availability of the higher precision DSN advanced VLBI navigation system required for Galileo navigation and science measurements would also be at risk.

PROJECT DESCRIPTION:

This project provides for the construction of a one-story technical facility of approximately 13,300 square feet (1,240 square meters). The facility will be located in the northwest section of JPL (Figure 1) to achieve

the greatest possible isolation from vibration and magnetic disturbances. It will include testing and instrumentation area laboratories, technical and support areas, and mechanical and equipment areas (Figure 2). Three controlled-environment test cells will be installed for long duration hydrogen maser calibration testing. Raised computer flooring, electrical systems, and mechanical systems will be provided for the laboratory and test areas. The facilities' electrical and mechanical systems will include back-up features to maintain the continuous electrical power and controlled environment required for long duration maser testing. Fire protection systems for the entire facility will also be provided.

PROJECT COST ESTIMATE:

This cost estimate is based on a preliminary engineering report.

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition.	---	---	---	
Construction.....	---	---	---	2,700,000
Sitework.....	LS	---	---	300,000
Architectural/structural.....	SF	13,300	72.20	960,000
Test cells.....	EA	3	220,000	660,000
Mechanical.....	LS	---	---	480,000
Electrical.....	LS	---	---	300,000
Equipment	---	---	---	---
Fallout Shelter (not feasible).....	---	---	---	---
Total.....				2,700,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Floor Plan

OTHER EQUIPMENT SUMMARY:

No other equipment is required for this project.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No future CoF funding is required to complete this project.

JET PROPULSION LABORATORY
FISCAL YEAR 1984 ESTIMATES
CONSTRUCTION OF FREQUENCY STANDARDS **LABORATORY**

FLOOR PLAN

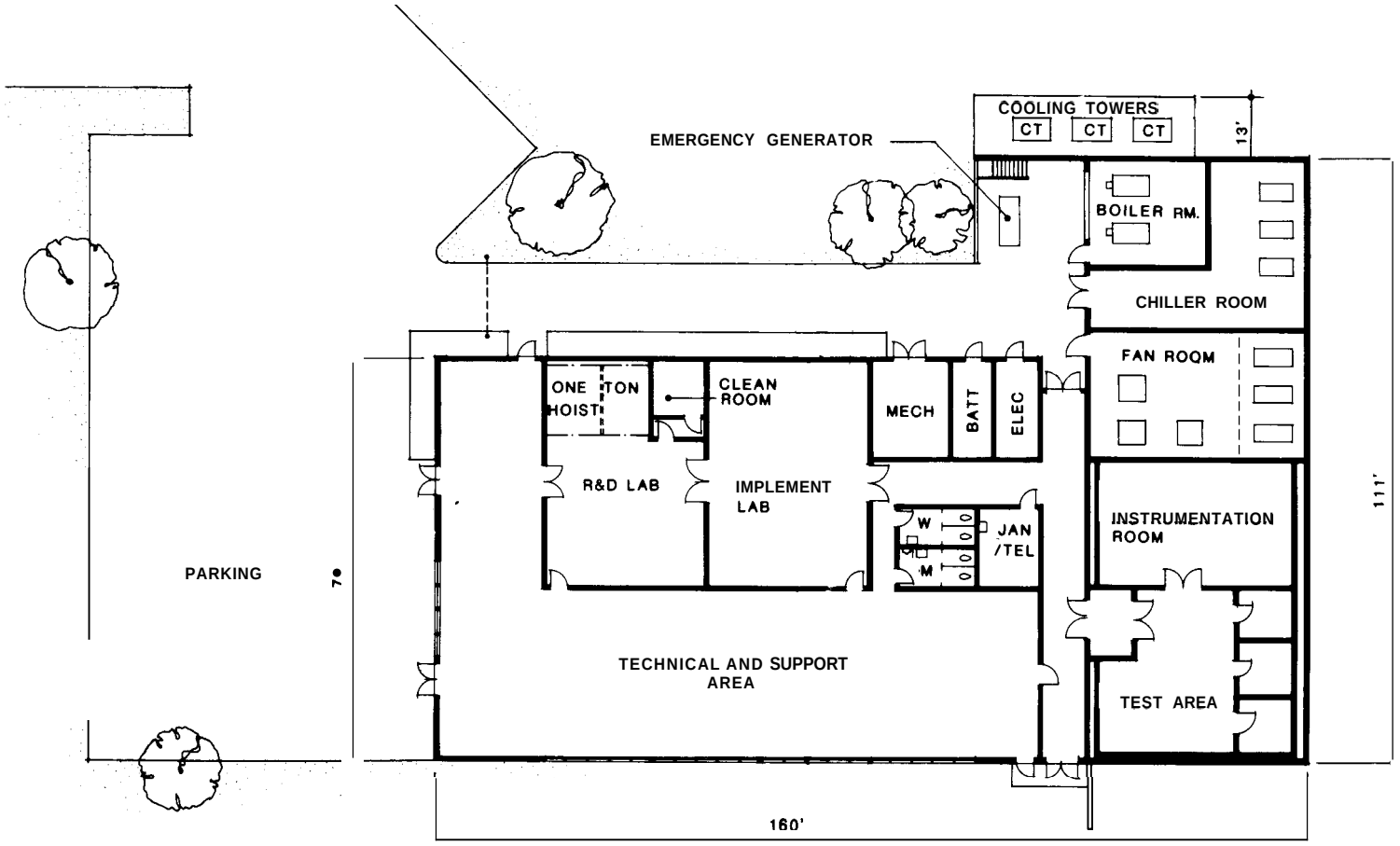


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FIGURE 2

JET PROPULSION LABORATORY
FISCAL YEAR 1984 ESTIMATES
MODIFICATIONS TO SPACE FLIGHT OPERATIONS FACILITY (230)

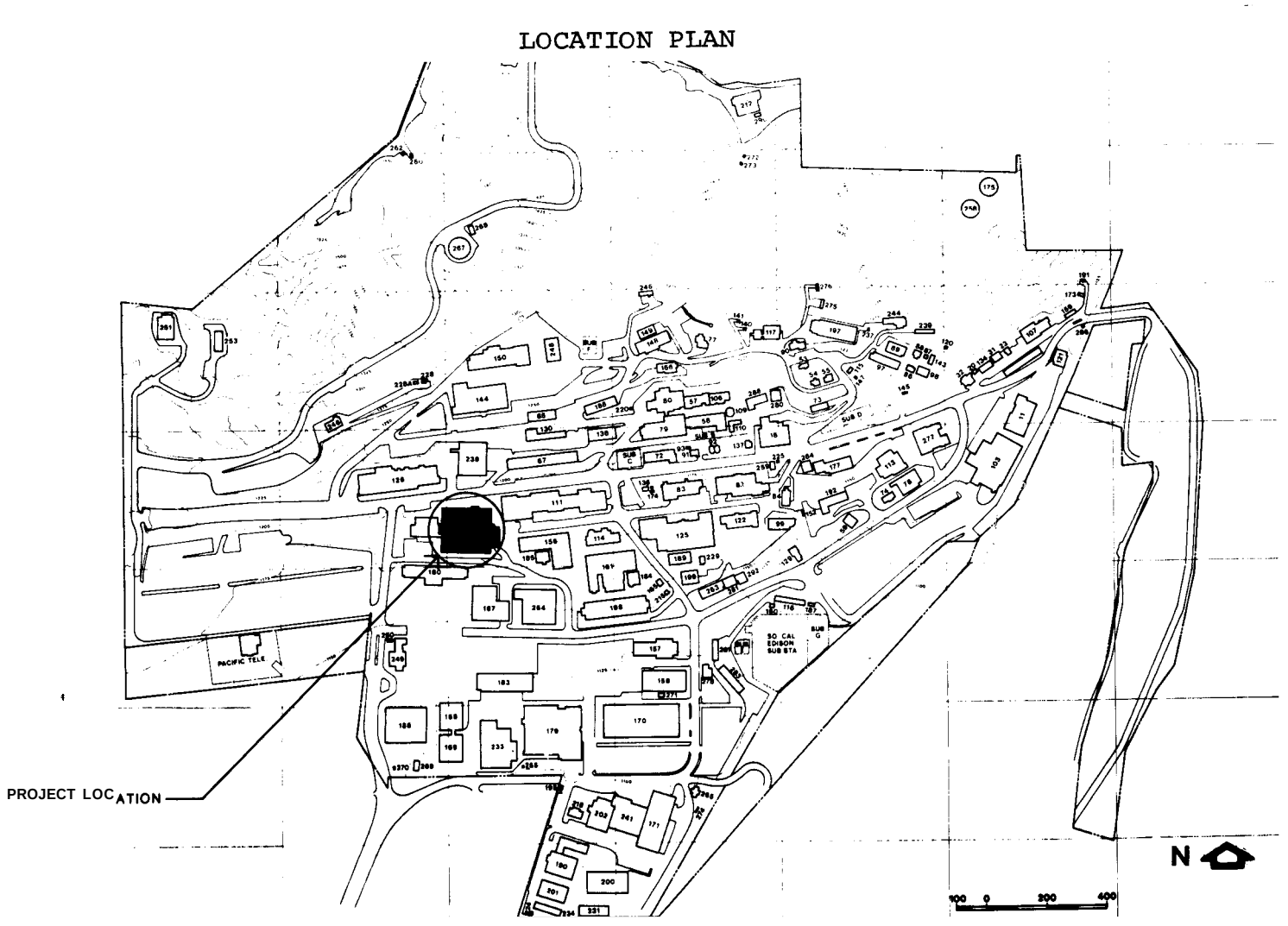


FIGURE 1

PROJECT TITLE:	Modifications to Space Flight Operations Facility (230)
INSTALLATION:	Jet Propulsion Laboratory
FY 1984 CoF ESTIMATE:	$1,600,000

LOCATION OF PROJECT: La Canada-Flintridge, Los Angeles County, California

COGNIZANT HEADQUARTERS OFFICE: Office of Space Science and Applications

FY 1983 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	416,800	1,800,000	2,216,800
Capitalized investment	N/A	9,083,513	9,083,513
Total	416,800	10,883,513	11,300,313

SUMMARY PURPOSE AND SCOPE:

This project provides for modifications to the Space Flight Operations Facility (SFOF), Building 230, at Jet Propulsion Laboratory (JPL). The SFOF is the operational "nerve center" for all space flight control activities at JPL. This facility contains real time computers and operational equipment, and is the terminal for the NASA Deep Space Tracking Network and worldwide communications system. The building was constructed in 1963 and has been expanded over the intervening years to support planetary exploration programs.

These modifications will complete the enclosure of the fourth floor equipment level to protect against weather damage to the building and the installed operational equipment. Also, the heating, ventilating, and air-conditioning (HVAC) systems will be modified for more reliable and efficient operation.

PROJECT JUSTIFICATION:

JPL is responsible for conducting NASA programs for scientific exploration of the planets and interplanetary space using automated spacecraft. This includes the operation of NASA's worldwide deep space tracking network and a mission control and computing center. The SFOF houses the mission control activities where computers, communications systems, and associated instrumentation must operate continuously in a closely controlled environment.

The SFOF is a combination communications, operations control, computer, and office building. From 1963 to 1969, four additions to the original SFOF were constructed to meet increasing capacity and technology requirements. To partially integrate the various HVAC systems that had been installed over the time period, a central chiller plant was constructed in FY 1979. The chiller plant was connected to the existing air distribution equipment which is located on the partially enclosed fourth floor of the building. Completion of the enclosure over the fourth floor equipment is necessary to provide improved safety conditions and weather protection for this equipment.

The major elements of the HVAC equipment have been in continuous operation for over 20 years and require major repairs or replacement. An example is the temperature control valves which are not operable and must be replaced. The new controls will be energy efficient and compatible with the utility control system. These modifications to the SFOF are required for effective support of planetary exploration programs as well as for fire safety considerations.

IMPACT OF DELAY:

Delay in accomplishing these modifications in this key operations control facility for spacecraft operations will prolong the present inefficient and unreliable conditions and increase the risk of mission interruptions.

PROJECT DESCRIPTION:

This project provides for modifications to the fourth floor and HVAC system of the SFOF (Figure 2). Modifications to the fourth floor include completing the enclosure of the equipment area of 28,500 square feet (2,648 square meters) with corrugated metal siding similar to the third floor and a metal roof system. The existing roofing surface will be replaced with a composition membrane. An automatic fire protection system

will be provided for the equipment area, and related structural, mechanical, and electrical repair work will be accomplished.

The inadequate air distribution system equipment in the **SFOF** will be repaired. Atemperature control system compatible with the JPL utility control system and the chiller plant operations will be installed. Related modifications to floors, ceilings, partitions, and mechanical and electrical systems are also included.

PROJECT COST ESTIMATE:

The basis of this cost estimate is a preliminary engineering report.

	Unit of Measure	Quantity	Unit cost	Cost
Land Acquisition	---	---	---	---
Construction	---	---	---	1.600.000
Architectural/structural	SF	17,600	45.00	790,000
Fire protection	SF	28,500	2.10	60,000
Mechanical	LS	---	---	680,000
Electrical	LS	---	---	70,000
Equipment	---	---	---	
Fallout Shelter (not feasible)	---	---	---	---
Total				1,600,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - South Elevation

OTHER EQUIPMENT SUMMARY:

No other equipment is needed to complete this project.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No major CoF funding to complete this project is anticipated.

A

JET PROPULSION LABORATORY
FISCAL YEAR 1984 ESTIMATES
MODIFICATIONS TO SPACE FLIGHT OPERATIONS FACILITY (230)

SOUTH ELEVATION

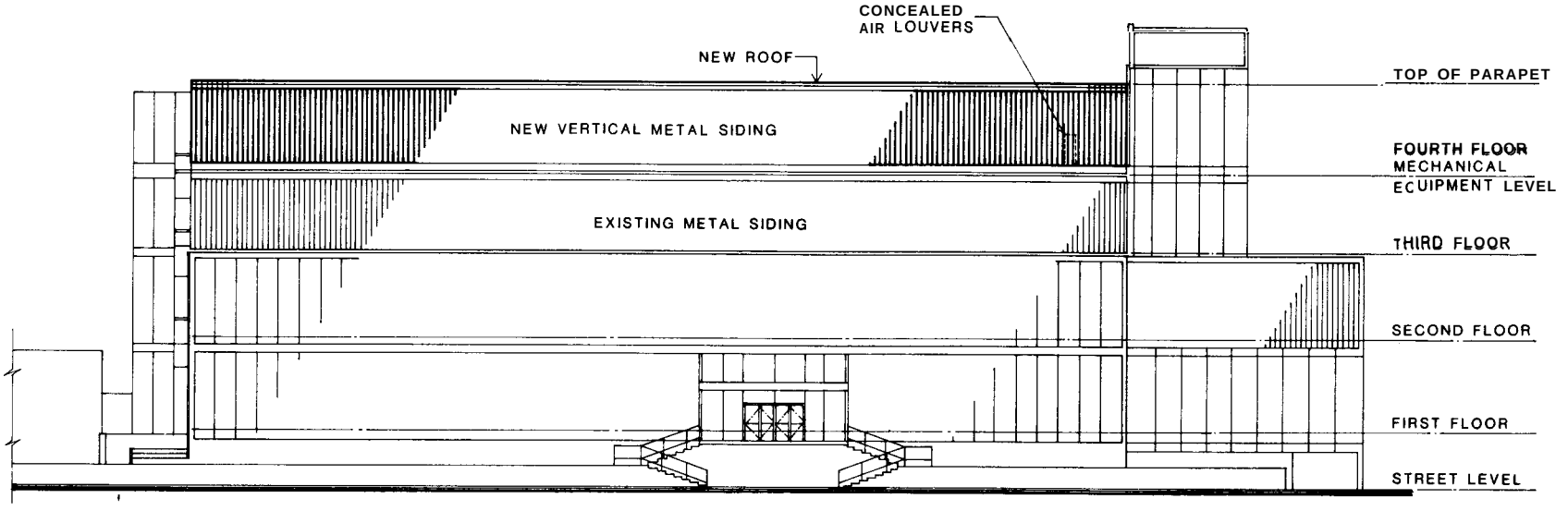


FIGURE 2

AMES RESEARCH
CENTER

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1984 ESTIMATES

SUMMARY

AMES RESEARCH CENTER

	Amount	Page No.
Office of Aeronautics and Space Technology:		
Construction of Fluid Mechanics Laboratory	3,900,000	CF 4–1

AMES RESEARCH CENTER
FISCAL YEAR 1984 ESTIMATES
CONSTRUCTION OF **FLUID** MECHANICS LABORATORY

LOCATION **PLAN**

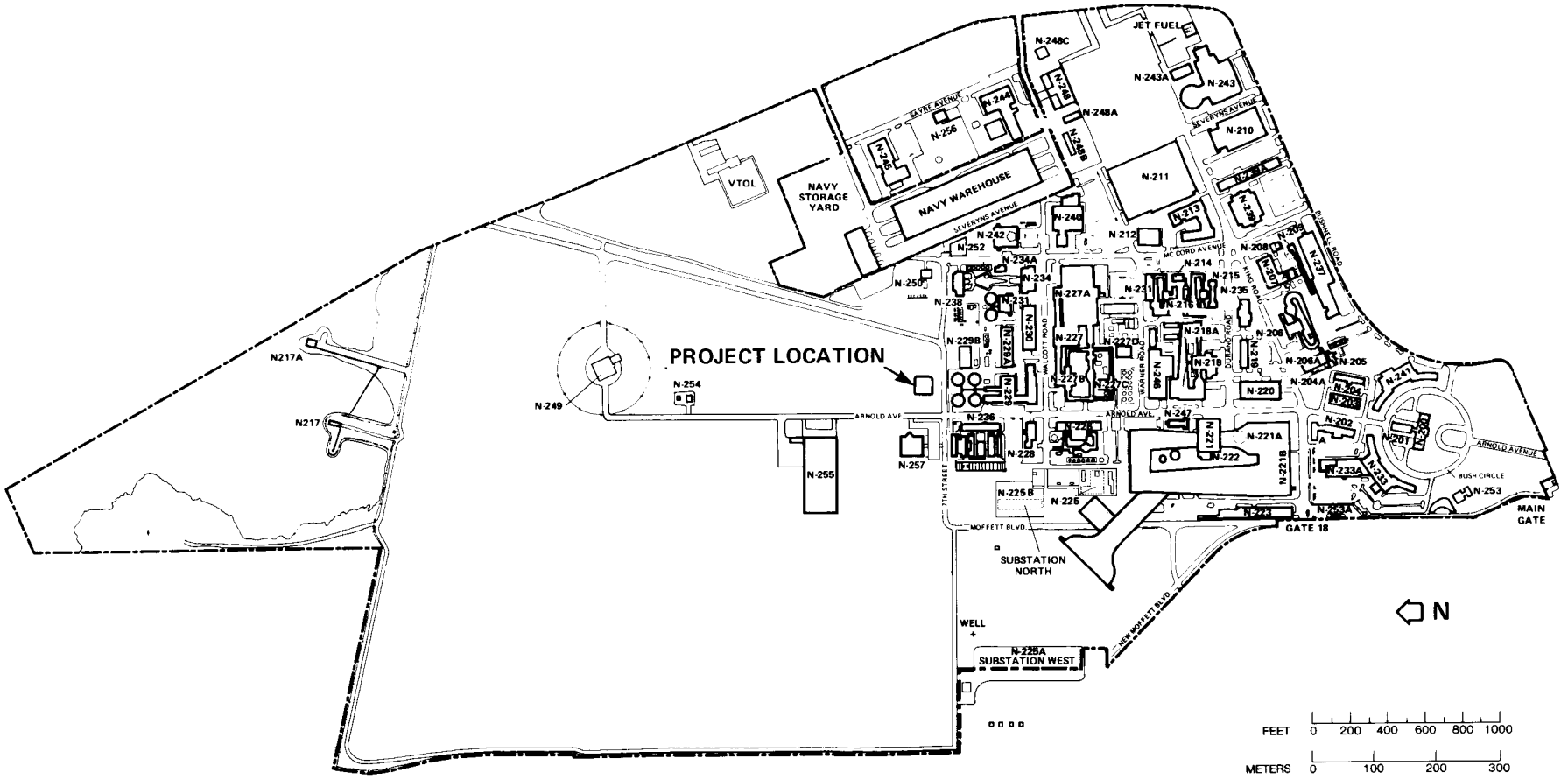


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1984 ESTIMATES

PROJECT TITLE:	Construction of Fluid Mechanics Laboratory
INSTALLATION:	Ames Research Laboratory
FY 1984 CoF ESTIMATE:	$3,900,000

LOCATION OF PROJECT: Moffett Field, Santa Clara County, California

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology

FY 1983 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	300,000	---	300,000
Capitalized investment	N/A	---	---
Total	300,000	---	300,000

SUMMARY PURPOSE AND SCOPE:

A primary function of Ames Research Center (ARC) is research in fundamental aerodynamics. The capability to conduct this research has been limited because the majority of the ARC wind tunnels are large and devoted to aerodynamic development. This project (Figure 1) provides a facility dedicated to basic fluid mechanics research that will house four small research wind tunnels. The four tunnels will be used for subsonic, transonic, adaptive wall, and multipurpose research. Two of these tunnels presently are located in makeshift space

with insufficient room for researchers and support equipment. The project also provides a small photographic darkroom and laboratory space for laser velocimeter and holography systems for use in research of nonintrusive measurement and diagnostic techniques for fluid flows.

When completed, this laboratory will be a versatile facility in which fundamental fluid mechanics research can be conducted by both NASA and cooperating university scientists. Compared to NASA's large wind tunnels, operating costs will be low, test models will be inexpensive, and waiting time for access to the tunnels will be minimal. Test data on viscous and unsteady flows, turbulence, flow separation, and shock-boundary layer interaction derived in this laboratory will provide the data base for advances in computational fluid mechanics and aerodynamics of fixed and rotary wing aircraft.

PROJECT JUSTIFICATION:

A fundamental part of the mission of ARC is basic fluid mechanics research. This research is the foundation for advances in computational fluid dynamics, aircraft performance and rotorcraft technology, and aerodynamic test facility development.

There is an urgent need to acquire basic fluid mechanics information on the details of viscous flows to build a data base for fluid dynamic models and to provide direction for future fluid mechanics study and experimentation. Mathematical models, when verified, will be a powerful tool for improving aerodynamic technology. The fluid mechanics data base is necessary for this effort.

An understanding of the basic fluid mechanics of complex turbulent and separated flows, including shock-boundary layer interactions, is required for improvement of performance and flying qualities of current and advanced aircraft and rotorcraft. This facility will permit research into unsteady flows pertaining to improved rotor airfoils, rotor modeling, and powered-lift concepts. The physical models derived through mathematical modeling will be tested in this laboratory.

Research in the wind tunnels of this facility will improve the research capabilities of NASA's large wind tunnels. The small, approximately 1 square foot (.09 square meter) test section of one of the tunnels will be built with an adaptive wall, adjustable to approximately the shape of the streamlines of the air flow over the model being tested. This concept is expected to eliminate or reduce data inaccuracies caused by air flow shock waves created in a wind tunnel test section of fixed geometry. After improvement of this concept, its application to large wind tunnels will materially increase the quality of data gathered in these large tunnels. Nonintrusive laser diagnostics, already in use, will be further studied in this laboratory. This technique offers the possibility of highly accurate air flow measurements and more thorough understanding of complex fluid mechanics.

This laboratory will provide an inexpensive means to optimize model configuration prior to testing in the large NASA wind tunnels. Power requirements will be low, tens of horsepower versus the thousands of horsepower required in large tunnels. Model costs will rarely exceed $5,000, versus up to $1,000,000, for large tunnels. Because of their small size and modular construction, modification of these tunnels for special experiments or improved technology applications will be simple and inexpensive.

IMPACT OF DELAY:

Delay of this project will slow the advancement of fluid mechanics and aerodynamics knowledge. NASA will be unable to take advantage of recent concepts in wind tunnel technology and instrumentation in a timely manner.

PROJECT DESCRIPTION:

This project (Figure 2) provides a 16,000-square foot (1,486 square meter) Fluid Mechanics Laboratory (FML). The FML will include 9,360 square feet (870 square meters) for four indraft tunnels and model set-up area. Two of the tunnels are existing and will be relocated to this laboratory from Building N-227. The two additional tunnels will be provided with R&D funds. The laser research area and associated photographic darkroom will occupy 1,536 square feet (143 square meters). Research library, conference, and support space will occupy 3,840 square feet (357 square meters). The balance of the building will house mechanical equipment, storage, and utilities. All four tunnels will be powered by a single compressor mounted outside the building and connected to the tunnels by a manifold.

PROJECT COST ESTIMATE:

This cost estimate is based on a preliminary engineering report.

	Unit of Measure	Quantity	Unit cost	Cost
Land Acquisition.	---	---	---	---
Construction	---	---	---	2,318,000
Site preparation	LS	---	---	516,000
Architectural/structural	SF	16,000	76.13	1,218,000
Mechanical	LS	---	---	376,000
Electrical	LS	---	---	208,000
Equipment.	---	---	---	1,582,000
Research tunnels compressor	EA	1		1,569,000
Relocate two research tunnels	LS	---	---	13,000
Fallout Shelter (not feasible)	---	---	---	---
Total				3,900,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Floor Plan

OTHER EQUIPMENT SUMMARY:

Two small tunnels will be provided with R&D funds. The estimated cost is $500,000.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No future funding is required to complete this project. However, the building will be designed to be expandable for the possible future relocation of an existing 2- x 2-foot (.6- x .6-meter) transonic wind tunnel.

AMES RESEARCH CENTER
FISCAL YEAR 1984 ESTIMATES
CONSTRUCTION OF FLUID MECHANICS LABORATORY

FLOOR PLAN

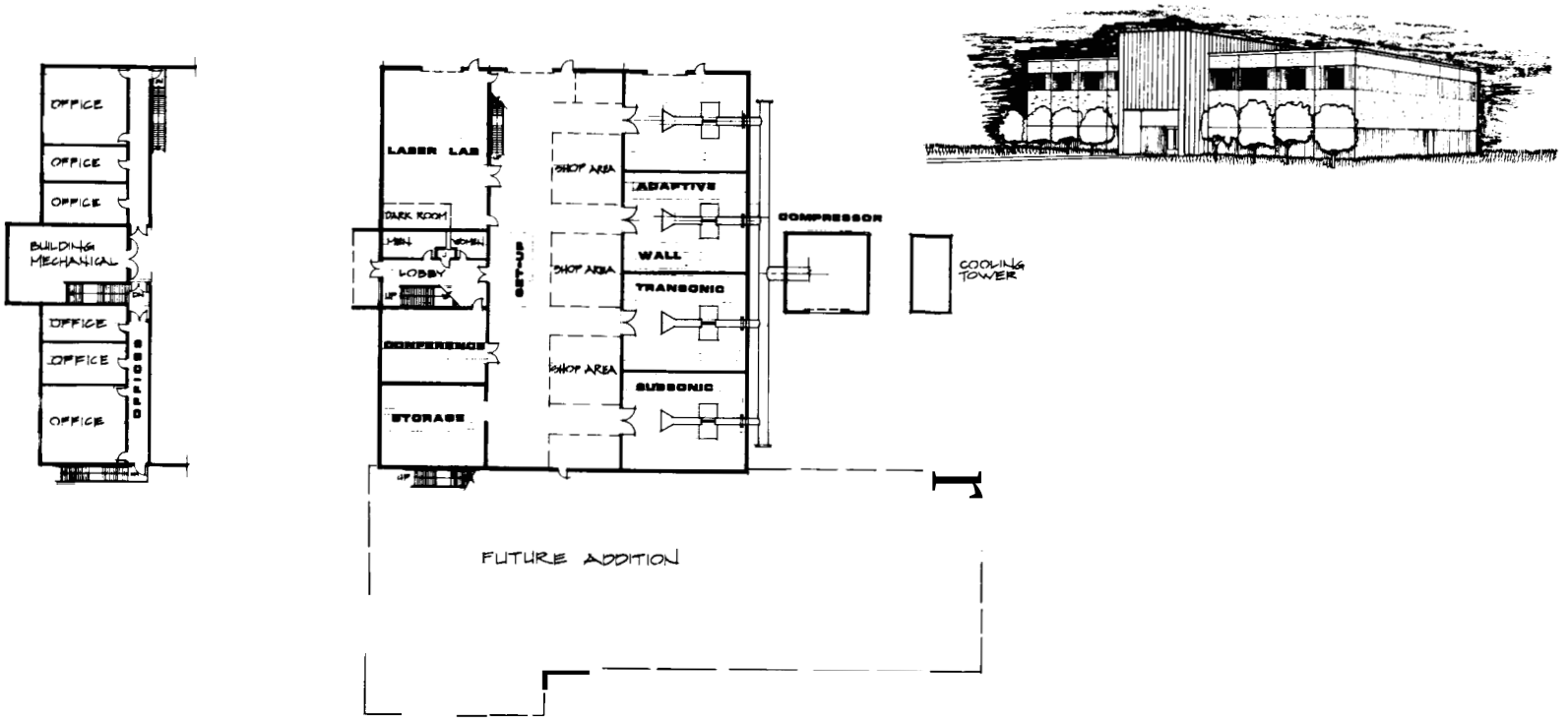


FIGURE 2

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1984 ESTIMATES

SUMMARY

DRYDEN FLIGHT RESEARCH FACILITIY

	Amount	Page No.
Office of Space Tracking and Data Systems:		
Construction of Aeronautical Tracking Facility	800,000	CF 5-1

DRYDEN FLIGHT RESEARCH FACILITY
FISCAL YEAR 1984 ESTIMATES
CONSTRUCTION OF AERONAUTICAL TRACKING FACILITY

LOCATION PLAN

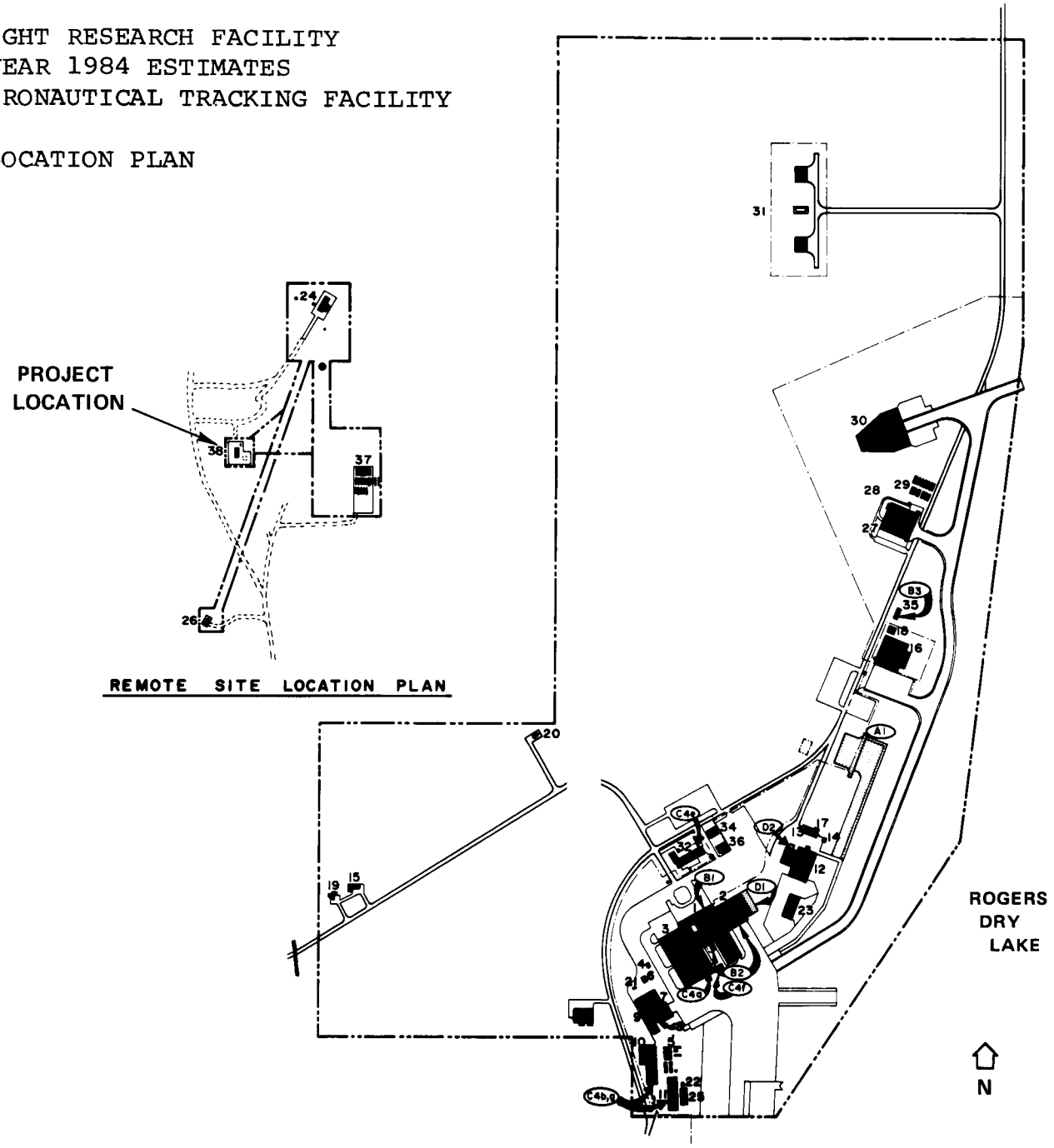


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1984 ESTIMATES

PROJECT TITLE: Construction of Aeronautical Tracking Facility

INSTALLATION: Dryden Flight Research Facility

FY 1984 CoF ESTIMATE: $800,000

LOCATION OF PROJECT: Edwards, Kern County, California

COGNIZANT HEADQUARTERS OFFICE: Office of Space Tracking and Data Systems

FY 1983 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding.....	62,000	---	62,000
Capitalized investment.....	N/A	---	---
Total.....	62,000	---	62,000

SUMMARY PURPOSE AND SCOPE:

This project provides for the construction of an Aeronautical Tracking Facility (ATF) at the Dryden Flight Research Facility (DFRF), a component of Ames Research Center. The Aeronautical Test Range (ATR) at DFRF is operating at full capacity in support of NASA and DOD flight test activities. The ATF is a vital element in expanding DFRF's capability to support increased flight test missions for aeronautical programs such as the Advanced Fighter Technology Integration F-16, Forward Swept Wing (X-29A), and Systems Driven Advanced Aircraft. The facility will include the equipment support to accommodate the additional tracking systems required for flight test missions planned for DFRF.

PROJECT JUSTIFICATION:

The primary mission of the DFRF is to conduct aeronautical flight research and provide long-term Space Shuttle support. The DFRF ATR is currently used extensively in support of priority national defense programs and technological advancements directly applicable to the commercial aviation industry, which is experiencing strong foreign competition. The ATR has been identified by the White House Office of Science and Technology as a critical and unique national resource for aeronautical research testing.

The DFRF ATR is supported by a tracking system that covers the supersonic corridors within approximately a 600-mile radius about DFRF. NASA and the Air Force cooperate to support the testing needs of both organizations. Under this arrangement, NASA is responsible for the operation and maintenance of the ATR. Currently, the ATR is supported by a single aeronautical tracking system with no backup. A dramatic growth in the number of test flights and the average flight duration over the past 2 years (40 percent and 30 percent, respectively) has caused the existing single tracking system to reach its maximum capability of supporting 400 flights per year. Valid aeronautical flight test requirements continue to increase and will require an ATR capability to handle approximately 800 flights per year. The ATF is required to accommodate the additional antennas, antenna electronics, and communications necessary to conduct simultaneous real-time missions of this magnitude. The facility must be sited at a remote area of DFRF to provide line-of-sight radio frequency communication paths to the aircraft operational areas, Edwards AFB north facilities and remote desert test corridors. This facility must be brought on line via an FY 1984 project to support the rapidly increasing aeronautical flight test requirements.

IMPACT OF DELAY:

Delay in this project would result in not providing the essential aeronautical tracking support required for the rapidly increasing NASA and DOD research program flight testing in support of the Nation's aeronautical goals.

PROJECT DESCRIPTION:

This project provides for the construction of an ATF near the Space Flight Tracking and Data Network Facility at DFRF (Figure 1). Site development work includes over 400 linear feet (120 meters) of access road, parking, telemetry antenna foundation, and utility services. Construction work includes a 2,200-square foot (200 square meter) one-story masonry equipment support facility with a reinforced concrete radar antenna pedestal (Figure 2). The operations room will include a raised computer floor system. Also included are heating, ventilating, air-conditioning, lighting, electrical power, and fire protection systems.

PROJECT COST ESTIMATE:

This cost estimate is based on a completed preliminary engineering report.

	Unit of Measure	Quantity	Unit cost	Cost
Land Acquisition.	---	---	---	---
Site Work and Utilities (outside 5-foot line).....	LS	---	---	230,000
Construction.....	---	---	---	570,000
Architectural/structural.....	SF	2,200	120.45	265,000
Computer floor.....	SF	1,600	34.38	55,000
Mechanical.....	LS	---	---	110,000
Electrical.....	LS	---	---	140,000
Equipment.	---	---	---	---
Fallout Shelter (not feasible).....	---	---	---	---
Total.....				800,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Floor Plan

OTHER EQUIPMENT SUMMARY:

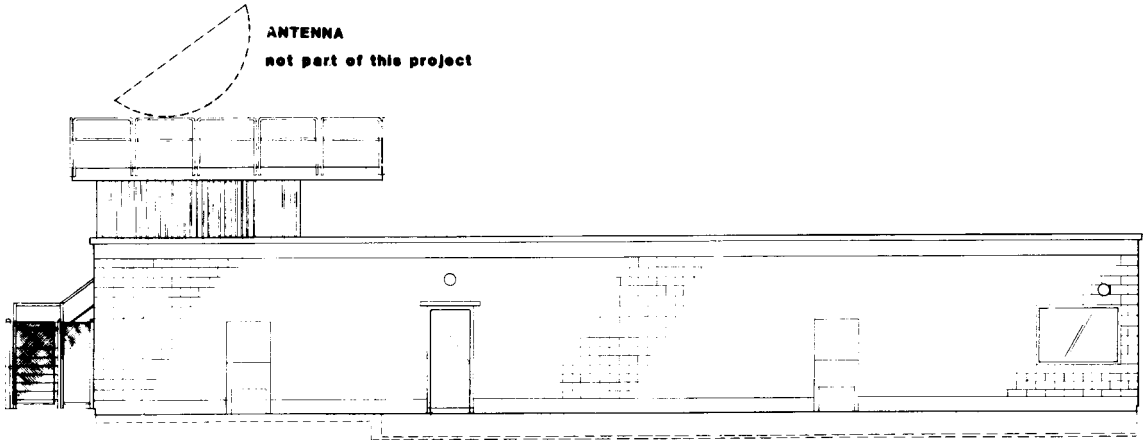
Tracking systems and equipment of $5.1 million are planned from the R&D resources.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

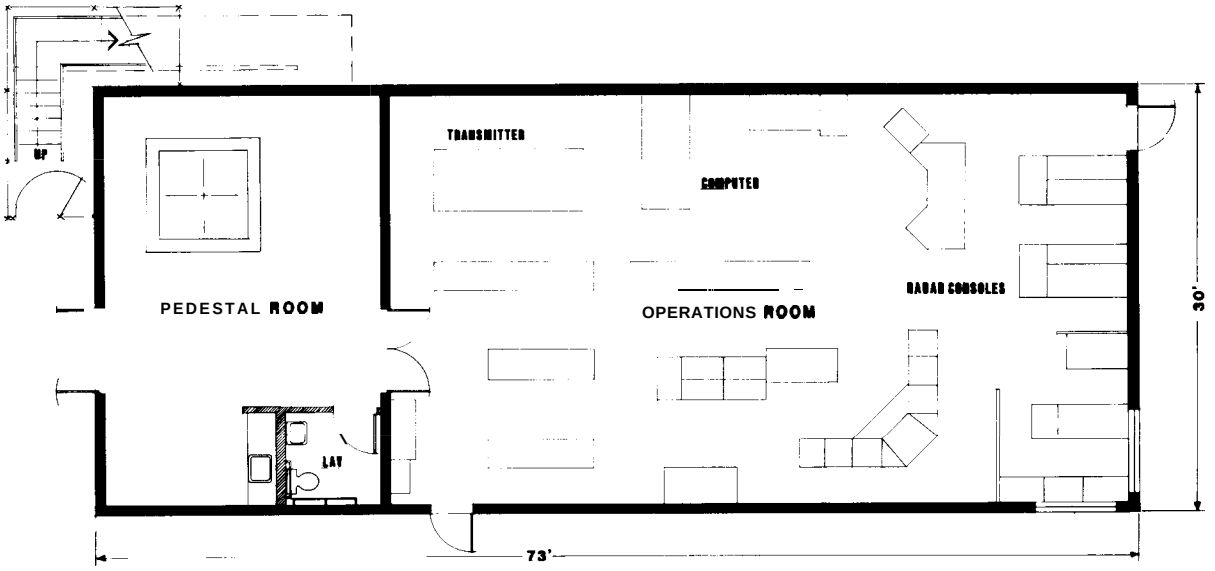
No future CoF funding is required to complete this project.

DRYDEN FLIGHT RESEARCH FACILITY
FISCAL YEAR 1984 ESTIMATES
CONSTRUCTION OF AERONAUTICAL TRACKING FACILITY

FLOOR PLAN



SOUTH ELEVATION



FLOOR PLAN

FIGURE 2

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1984 ESTIMATES

SUMMARY

LANGLEY RESEARCH CENTER

	Amount	Page No.
Office of Aeronautics and Space Technology:		
Modifications and Addition for Composite Materials Laboratory (1293A)	5,100,000	CF 6-1
Modifications to 30-by-60-Foot Tunnel (643)	4,400,000	CF 6-11
Total	9,500,000	

LANGLEY RESEARCH CENTER
FISCAL YEAR 1984 ESTIMATES
MODIFICATIONS AND ADDITION FOR COMPOSITE MATERIALS LABORATORY

LOCATION PLAN

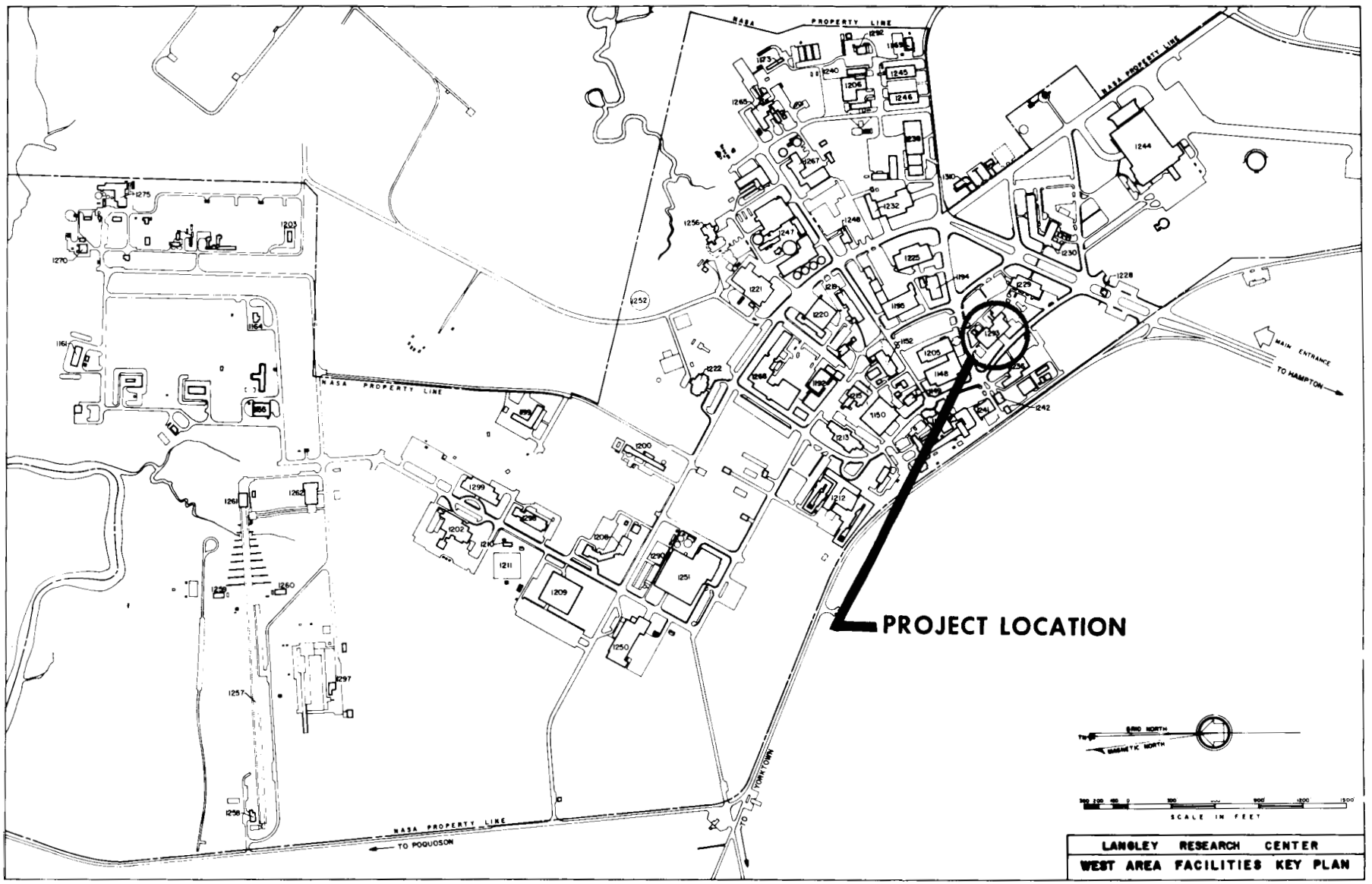


FIGURE 1

CF 6-1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1984 ESTIMATES

PROJECT TITLE:	Modifications and Addition for Composite Materials Laboratory (1293A)
INSTALLATION:	Langley Research Center
FY 1984 CoF ESTIMATE:	$5,100,000

LOCATION OF PROJECT: Hampton, Virginia

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology

FY 1983 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	510,000	300,000	810,000
Capitalized investment	N/A	6,334,739	6,334,739
Total	510,000	6,634,739	7,144,739

SUMMARY, PURPOSE AND SCOPE:

The project provides for an addition to and modification of existing laboratory and office space in Building 1293A (Figures 2 & 3). Also included is the installation of a data link from Building 1293B to the Data Reduction Center, Building 1268. This project is required to accommodate advanced composite and polymer research activities that cannot currently be conducted in the 15-year old polymer laboratories. Deterioration of the hood and vent systems have restricted the ventilation capacity required for research and created an environmental problem in the existing labs of Building 1293A. The data link to be provided is required to increase the capability for real-time analysis in support of the large space structures program.

PROGRAM JUSTIFICATION:

The Langley Research Center (LaRC) has lead Center responsibility for the development and application of advanced composite materials (Figure 5) for aircraft and spacecraft, and for research on the dynamics and control of large space structures. Current work on composite materials processing and polymer research is performed at scattered sites within Buildings 1148 and 12936. Areas with adequate environmental control and required ventilation are not presently available, but are critically required for activities such as specimen layup, resin impregnation, and certain evaluation tests. The polymer laboratory facilities are over 15 years old and have deteriorated to the point where major refurbishment is needed. Fume hood and venting systems (Figure 4) are severely corroded and are extremely inefficient because they draw building air and thus increase the load on the heating, ventilating, and air conditioning (HVAC) system. Also, fresh air intakes for the HVAC system are not adequately separated from the venting system. Therefore, noxious fumes from the processing area are sometimes cycled throughout the building. The new polymer research laboratories will have energy efficient hood systems and provide for safer disposal of toxic fumes.

Some polymer synthesis processes, such as hydrogenation and pressure polymerization, cannot be performed safely in the present facility. The new facility addition will provide the appropriate features for safely conducting such research so that there is proper ventilation from noxious fumes and an environmentally controlled area is available to conduct this research. These processes are needed in a program to develop more economical and processable resin matrix materials.

Large space structures are being developed for various applications such as general purpose platforms and antennas. The dynamic response of such structures is complicated by the presence of many joints. Current research is limited by the number of control parameters or control points that can be monitored or interactively varied during a test; hence, a data link system between the dynamics laboratory and the LaRC central computers will provide a ten-fold improvement in this capability. The data link can be used to evaluate various control laws, actuator/sensor dynamics, and the real-time evaluation of data.

IMPACT OF DELAY:

A delay in the approval of this project would preclude any research related to the processing of thermoplastics and composite materials. This technology has high potential for reducing fabrication costs but more work is needed to develop both the materials and the processes to the point where they can replace current thermosetting resin systems. As an example of the penalty of delay, the manufacture of present-day helicopter airframes is labor intensive, and new, more processable composite materials could reduce airframe cost while providing significant weight savings. Also, present-day transports have benefited from recent NASA research and development of composite structures. A significant increase in the use of composites on future aircraft is dependent on improvements in materials and processes over those available today.

PROJECT DESCRIPTION:

The project provides for modification of 15,000 square feet (1,394 square meters) of laboratory and office space, a 2-story, 25,000-square foot (2,320 square meter) addition to Building 1293A (Figure 3), and a connecting 200-channel data link to Building 1268 from 1293B. An advanced composites processing laboratory will be located on the first floor of the addition. Existing equipment will be moved to the new laboratory from various sites in Buildings 1148 and 1293A. Portions of the laboratory will have independent environmental control to vent noxious fumes released during resin impregnation and composite curing processes. Special facilities will be incorporated to store and handle chemicals and uncured composite materials.

New polymer research laboratories will be constructed on the second floor of the new addition. The new laboratories will incorporate provisions for conducting special synthesis processes such as hydrogenation and pressure polymerization. Polymer characterization and evaluation equipment will be moved from the existing laboratories into the new space.

The data link includes the interfaces required to accept data from each end. Also, a data storage device and signal converters to transmit and receive the data from the existing computers in Building 1268 are included as part of this project.

Architectural refurbishment of Building 1293 will include new windows and wall panels with improved thermal insulation. Existing laboratories in Building 1293A will be restored to needed office space after the laboratory equipment is removed. Refurbishment of the HVAC, lighting, and ceilings will be included.

PROJECT COST ESTIMATE:

This is an in-house cost estimate based on criteria and concepts.

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition	---	---	---	---
Construction	---	---	---	4,950,000
Chemical laboratories (2-story addition)	SF	25,000	172.80	4,320,000
Civic	---	---	---	(640,000)
Architectual	---	---	---	(1,400,000)
Mechanical/electrical	---	---	---	(2,072,000)
Miscellaneous	---	---	---	(208,000)
Rehabilitation	SF	15,000	42.00	630,000
Equipment	---	---	---	150,000
Real-time data link	---	---	---	150,000
Fallout Shelter (not feasible)	---	---	---	---
Total				5.100 .000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Site Plan
Figure 3 - New Composite Materials and Polymer Laboratory
Figure 4 - Existing Composite Materials Laboratory
Figure 5 - Composite Materials Processing

OTHER EQUIPMENT SUMMARY:

No other equipment is required to complete this project.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

At the present time, there are no foreseen requirements which would require future CoF funding for this project.

LANGLEY RESEARCH CENTER
FISCAL YEAR 1984 ESTIMATES
MODIFICATIONS AND ADDITION FOR COMPOSITE MATERIALS LABORATORY

SITE PLAN

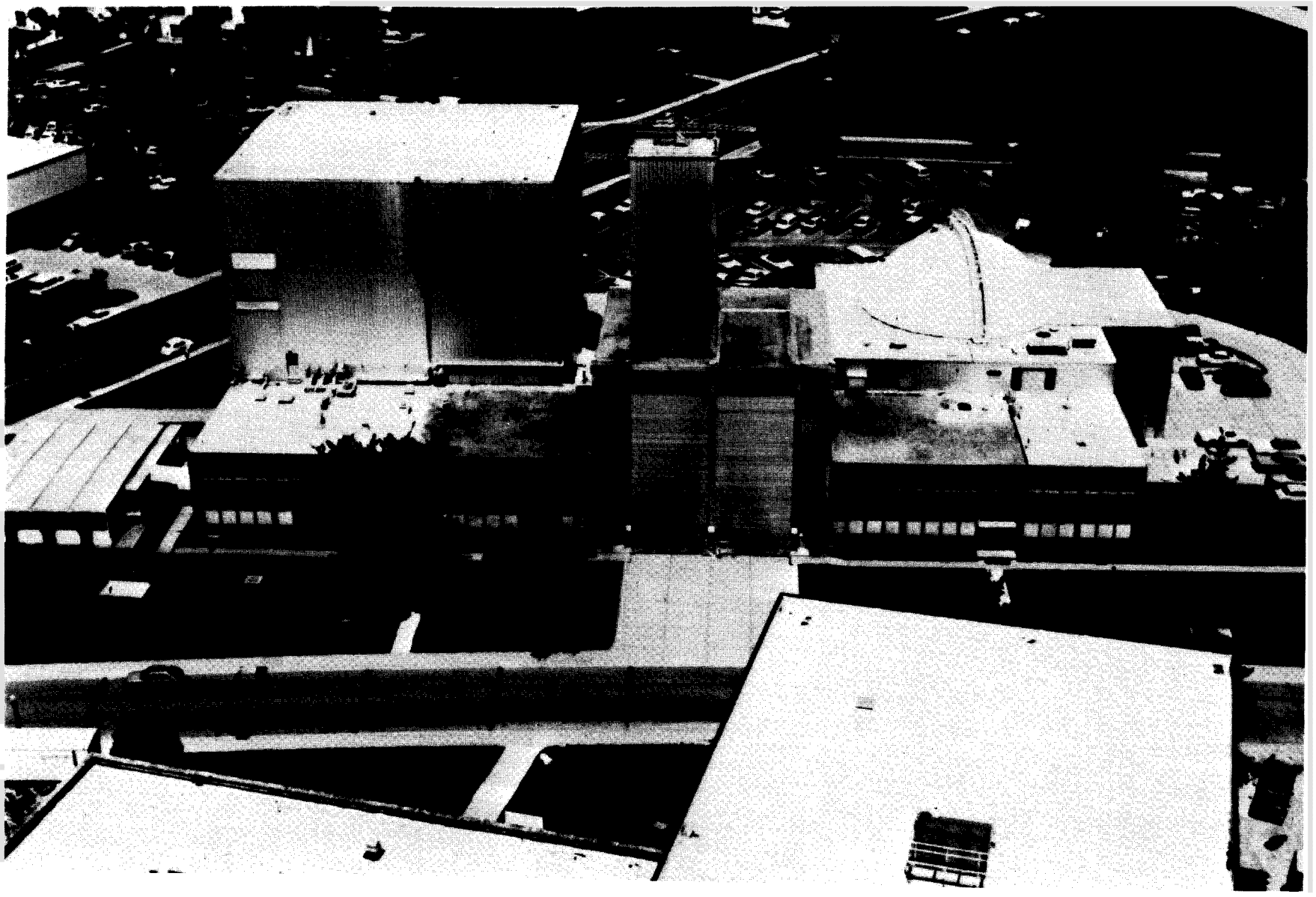


FIGURE 2

LANGLEY RESEARCH CENTER
FISCAL YEAR 1984 ESTIMATES
MODIFICATIONS AND ADDITION FOR COMPOSITE MATERIALS LABORATORY

NEW COMPOSITE MATERIALS AND POLYMER LABORATORY

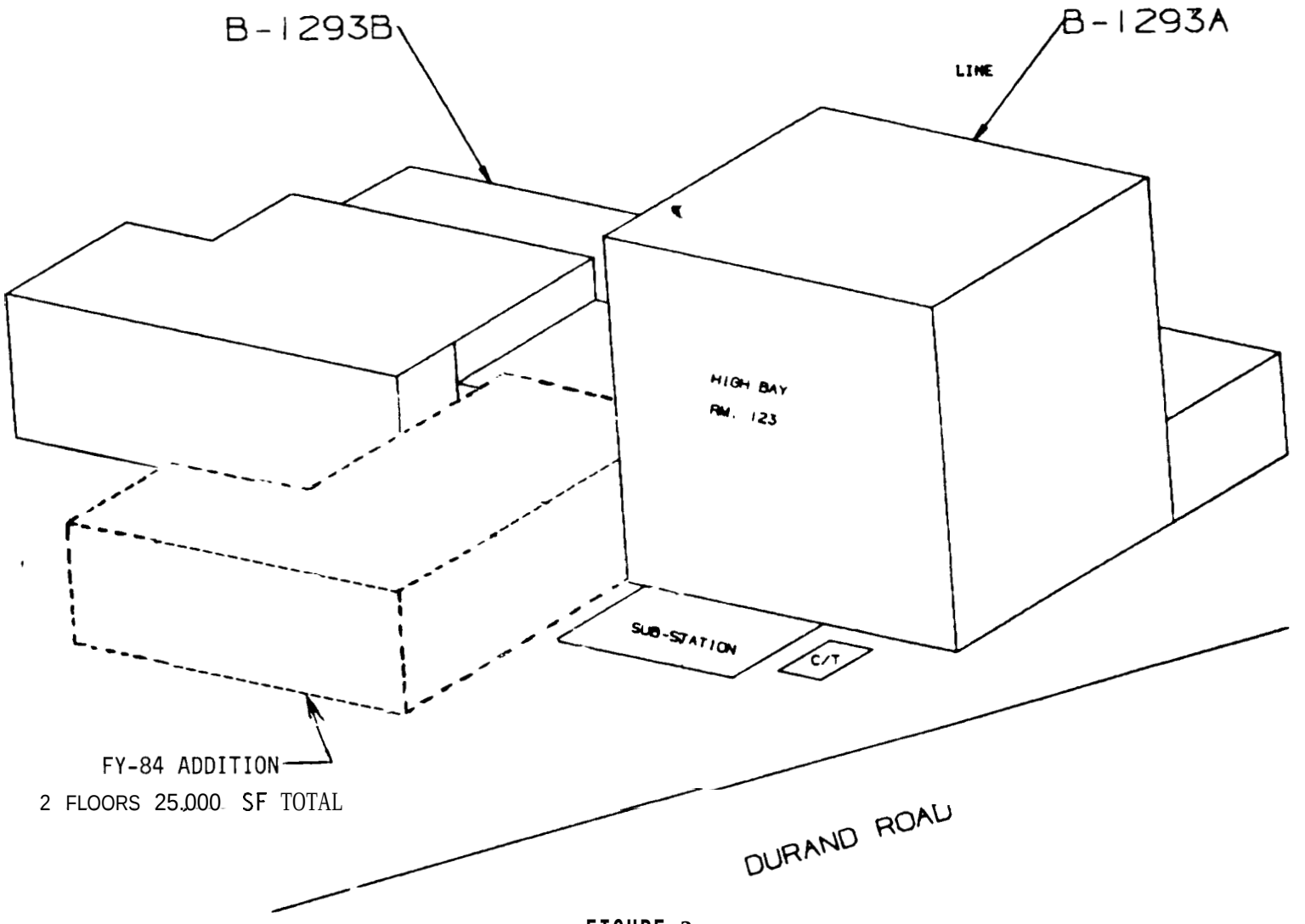


FIGURE 3

LANGLEY RESEARCH CENTER
FISCAL YEAR 1984 ESTIMATES
MODIFICATIONS **AND** ADDITION FOR COMPOSITE MATERIALS LABORATORY

EXISTING COMPOSITE MATERIALS LABORATORY

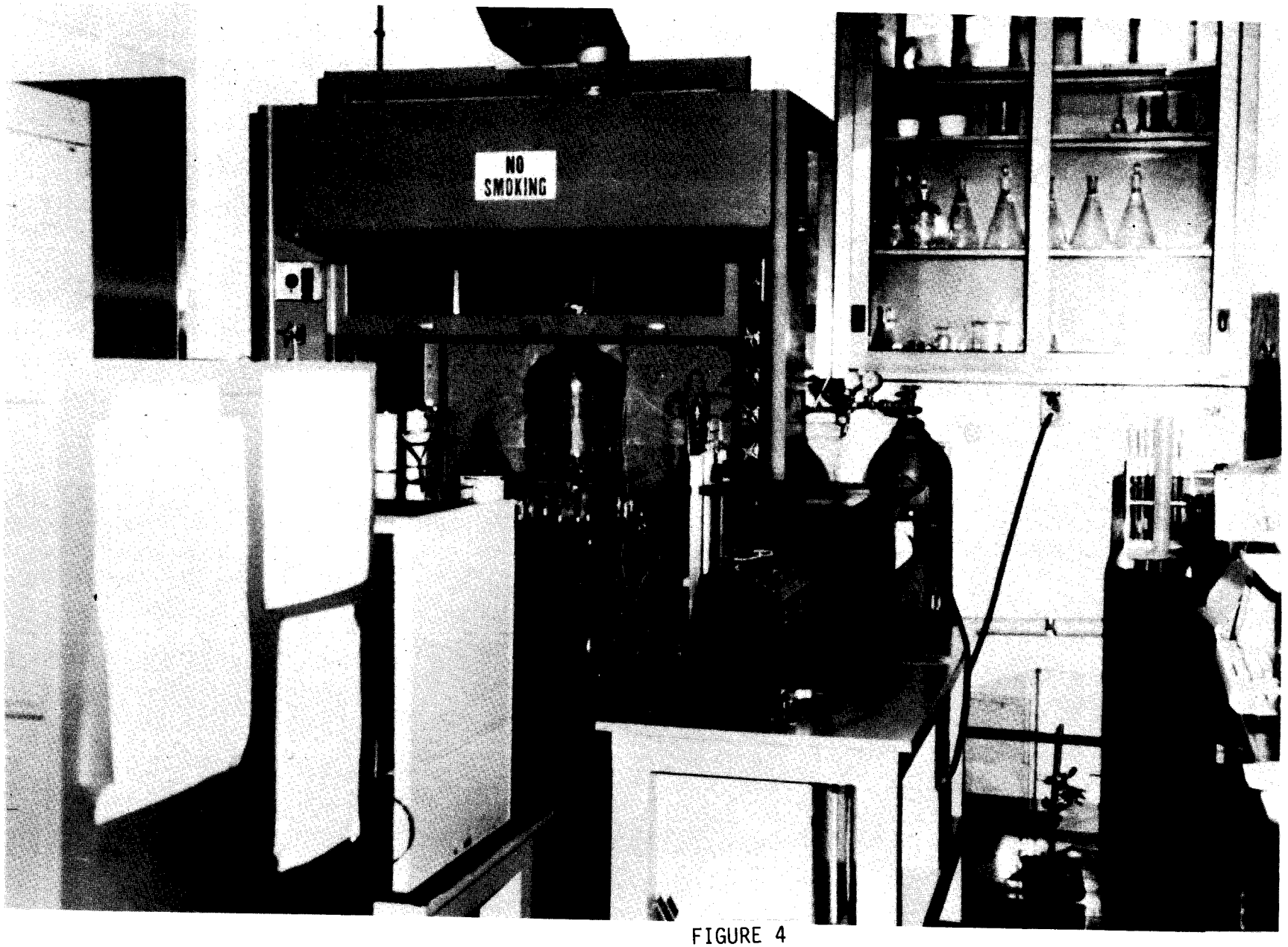


FIGURE 4

LANGLEY RESEARCH CENTER
FISCAL YEAR 1984 ESTIMATES
MODIFICATIONS AND ADDITION FOR COMPOSITE MATERIALS LABORATORY

COMPOSITE MATERIALS PROCESSING

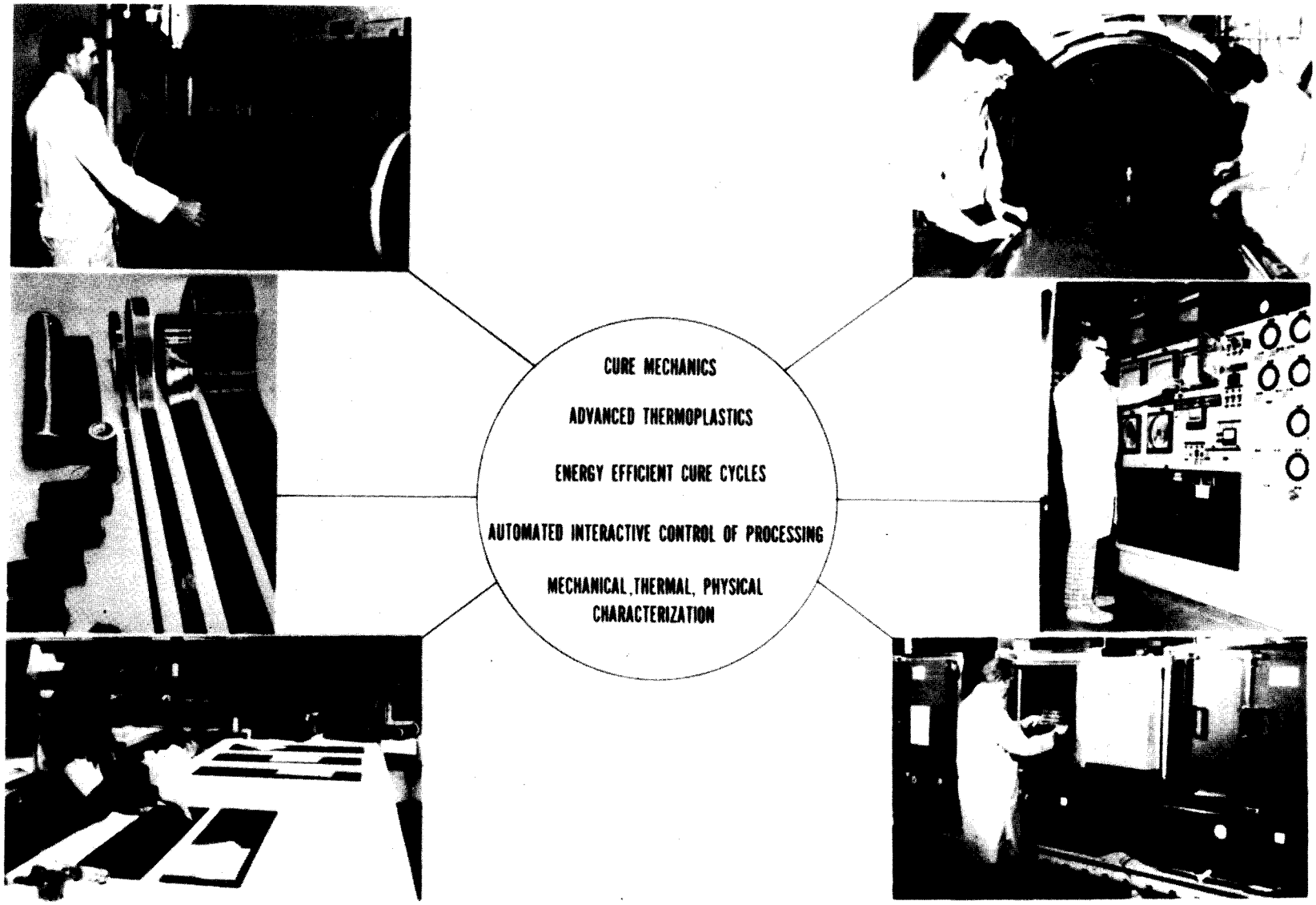


FIGURE 5

LANGLEY RESEARCH CENTER
FISCAL YEAR 1984 ESTIMATES
MODIFICATIONS TO 30- BY **60-FOOT** TUNNEL **(643)**

LOCATION PLAN

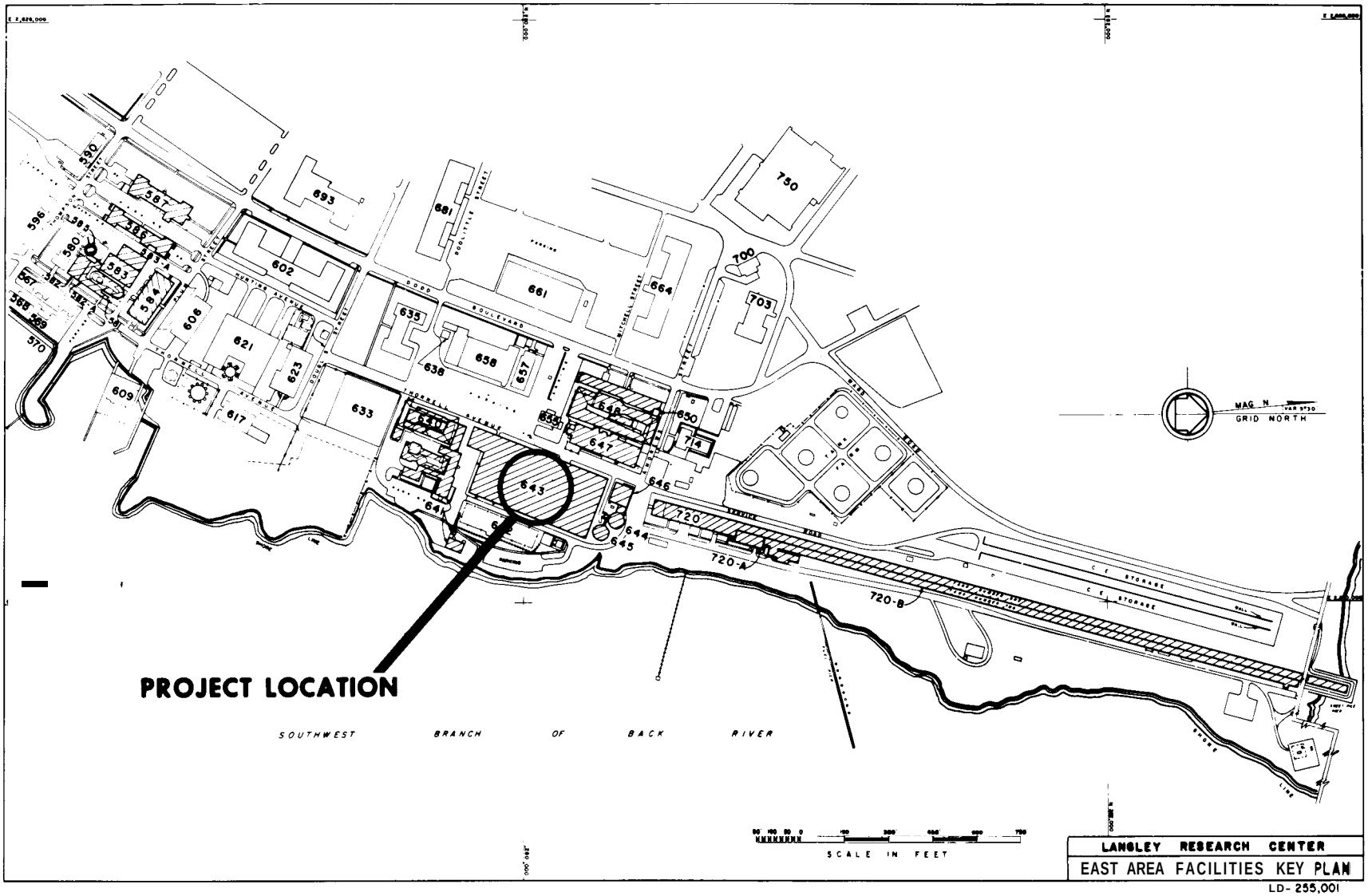


FIGURE 1

CF 6-11

PROJECT TITLE: Modifications to 30- by **60-Foot** Wind Tunnel (643)

INSTALLATION: Langley Research Center

FY 1984 CoF ESTIMATE: $4,400,000

LOCATION OF PROJECT: Hampton, Virginia

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology

FY 1983 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	440,000	340,000	780,000
Capitalized investment	N/A	5,204,307	5,204,307
Total	440,000	5,544,307	5,984,307

SUMMARY PURPOSE AND SCOPE:

The 30- by 60-foot (9 by 18 meter) wind tunnel at Langley Research Center (LaRC) is the only wind tunnel (Figures 1 and 3) in the United States capable of free-flight tests of models at subsonic speeds. Its unique open throat and related features provide critical free-flight qualitative and quantitative information on the dynamic characteristics of the test models.

The turntable and model support systems of this tunnel have been in operation since 1956, and require extensive repair and updating. The worn parts contribute to excessive relative motion of the test aircraft, and cause

many man-hours to be consumed in error investigation and necessary corrective measurements, calibrations, and calculations. The proposed modifications correct these deficiencies, and provide for increased productivity, efficiency, safety, model weight capability, and accuracy of data for this 50-year old facility.

PROJECT JUSTIFICATION:

The 30- by 60-foot (9 by 18 meter) wind tunnel is the only facility in the U.S which can be used to explore most low speed aspects of flight of highly maneuverable aircraft. It permits free-flight (Figure 5) testing of models instrumented with accelerometers, gyros, and attitude sensors to measure flight parameters; static and dynamic force and movement tests on the same configuration through +90-degree angle of attack; and large-scale models of the free-flight configuration at approach and landing conditions where Reynolds number effects can be significant. Free-flight testing helps identify and define critical test regions and parameters for conventional fixed aerodynamic testing. It also provides greater insight into unexpected or otherwise unexplainable problems that cannot be identified with conventional wind tunnel testing. Without such free-flight tests, some major problems would not be identified until actual flight tests were conducted and changes became extremely expensive.

In an open-throat test section (Figure 2) such as in the 30- by 60-foot (9 by 18 meter) tunnel, research engineers and pilots can be strategically placed to best obtain data and control the aircraft model. Even more important, the open-throat test section permits the model to be removed from the airstream in the event of a control malfunction. This feature eliminates damage or destruction of the model (typically costing up to $500,000) or the tunnel that would otherwise occur from the model striking a wall or other parts of the tunnel structure in a closed-throat test section.

The need for testing of large-scale aerodynamic configurations of both military and nonmilitary designs has produced a backlog of work in excess of 2 years. Such large-scale testing of current and future aircraft designs is essential to evaluate and develop stability and control characteristics. Current increased emphasis on improved low-speed performance for military aircraft will create additional requirements for the large-scale testing capabilities of LaRC's 30- by 60-foot (9 by 18 meter) wind tunnel.

These modifications will correct the present deficiencies and increase productivity through automated set-up of new models using a new adjustable three-strut support system and turntable system, and automated setting of tunnel test conditions of dynamic pressure, angle of attack, and sideslip.

IMPACT OF DELAY:

Delaying this project would adversely impact ongoing and planned programs for improving low-speed and high-angle-of-attack aerodynamic technology needed for both military and nonmilitary applications. Such delays would compromise LaRC's ability to respond to current requirements for developing high-performance military aircraft with greatly improved low-speed stability and performance needed for short-field capability. Delay would also result in continued deterioration of the model support system and the increasing chance of a major failure that could result in serious injury to personnel and/or destruction of the test vehicle.

PROJECT DESCRIPTION:

This project includes the replacement of the wind tunnel's model support and balance system (Figure 4), repair of lead seals, control room modifications, automation of tunnel controls, and fire protection improvements.

The model support and balance system consists of a turntable with three struts, ground plane, balance house and frame, and scale system. Installation of the new turntable system will require demolition of the balance house and construction of a new balance house; replacement of adjacent electrical equipment with new equipment; relocation and modification for digital readout of six scales and replacement of two other scales; construction and calibration of the turntable and model support system, removal of the existing turntable aerodynamic shroud and construction of a new shroud; and a final integrated checkout of the entire system.

The original lead seals where the tunnel air-passageway walls join the ceilings will be repaired. Additional cabling, conduit, and an isolation transformer will be installed in the tunnel control room for recently purchased data acquisition equipment, which will be installed in early 1984. The computer deck floor will be raised to provide space for cabling and an air-conditioning plenum. The overhead 5-ton air-conditioning unit will be replaced by a 10-ton unit. The third floor level balcony room will be extended approximately 14 feet (4 meters). Fire protection modifications include installation of automatic sprinkler systems over the tunnel test and shop areas, and wood portions of the tunnel as well as improvements to the water supply.

PROJECT COST ESTIMATE:

Project cost estimates are based on a completed preliminary engineering report,

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition	---	---	---	---
Construction	---	---	---	4,400,000
Model support and balance system	LS	---	---	3,640,000
Structural	LS	---	---	(700,000)
Mechanical	LS	---	---	(2,755,000)
Electrical	LS	---	---	(185,000)
Repair lead seals	LS	---	---	95,000
Control room modifications	LS	---	---	240,000
Tunnel automation	LS	---	---	110,000
Fire protection improvements	LS	---	---	315,000
Equipment	---	---	---	---
Fallout Shelter (not feasible).	---	---	---	---
Total				4,400,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Pilot Flying Model
Figure 3 - Tunnel Characteristics
Figure 4 - Proposed Model Support and Balance System
Figure 5 - Free-Flight Model

OTHER EQUIPMENT SUMMARY:

A new data acquisition system has been purchased with R&D funds. It will be installed in the tunnel control room.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

At the present time, there are no foreseen additional requirements other than roof rehabilitation and painting of the tunnel shell.

LANGLEY RESEARCH CENTER
FISCAL YEAR 1984 ESTIMATES
MODIFICATIONS TO 30- BY 60-FOOT TUNNEL (643)

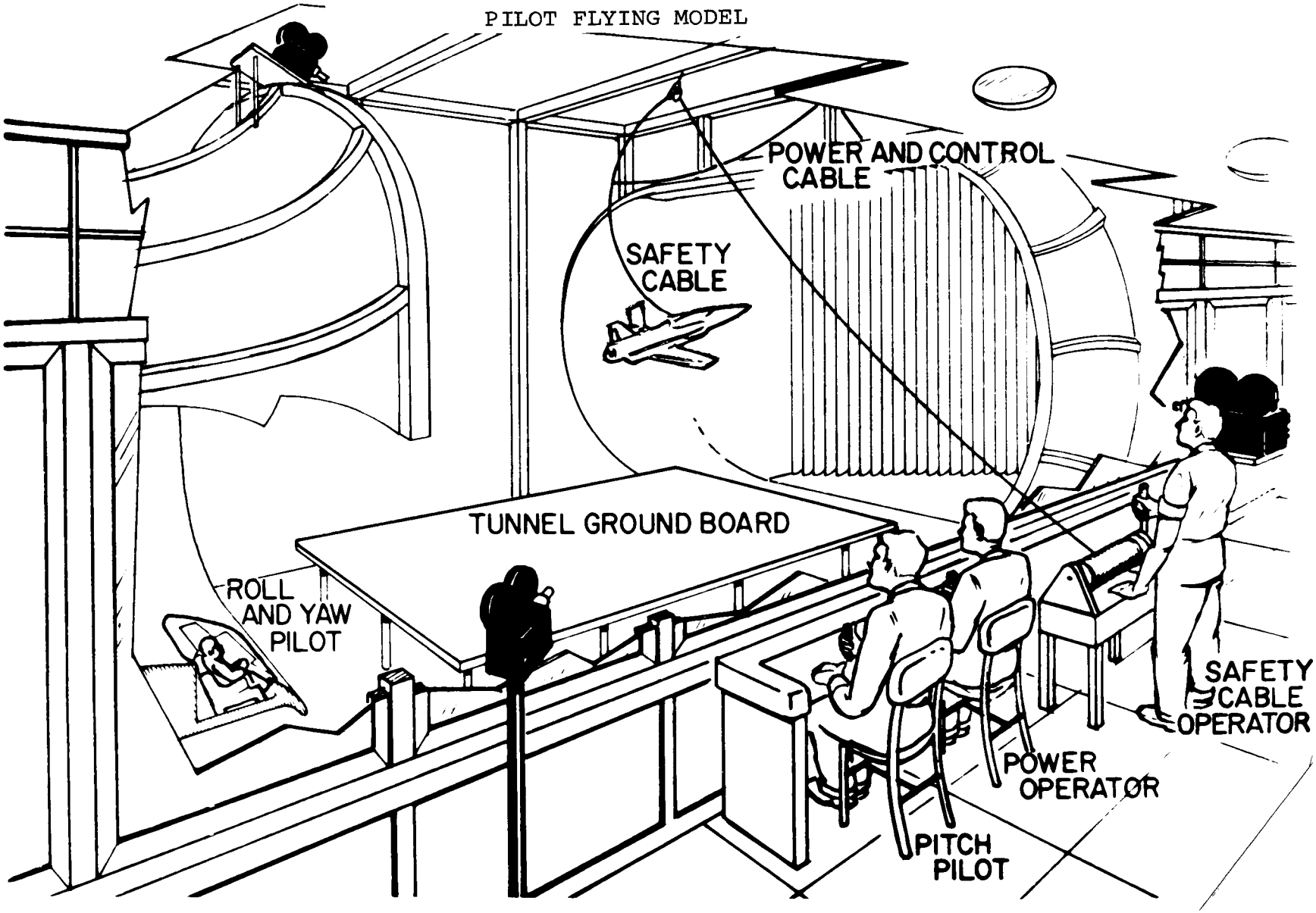
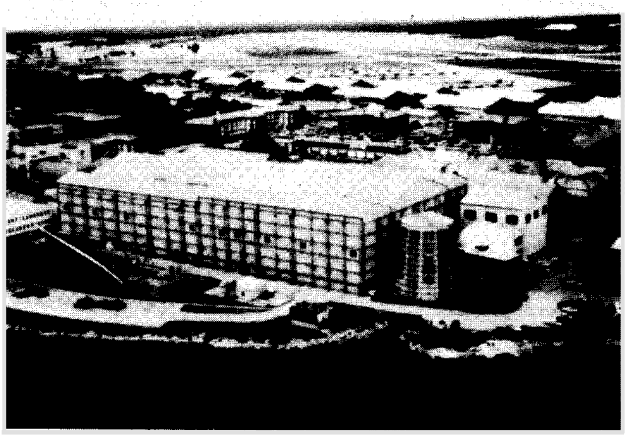


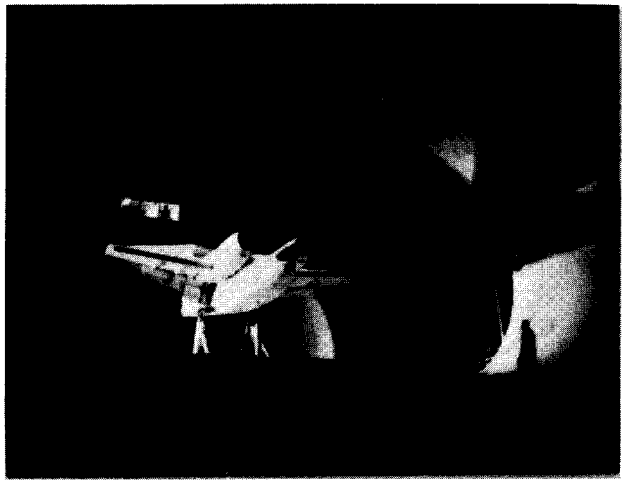
FIGURE 2

LANGLEY RESEARCH CENTER
FISCAL YEAR 1984 ESTIMATES
MODIFICATIONS TO 30- BY 60-FOOT TUNNEL (643)

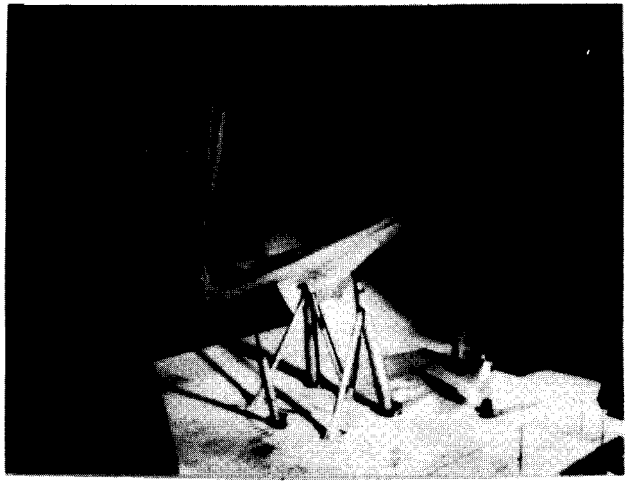
TUNNEL CHARACTERISTICS



- TEST SECTION - 30 FT x 60 FT x 56 FT
- SPEED - 25 TO 110 MPH
- REYNOLDS NUMBER - 0 TO 1 x 10^6 PER FT
- CONTINUOUS FLOW, ATMOSPHERIC PRESSURE
- GENERAL AERODYNAMIC INVESTIGATIONS AND MODEL TESTS AND AERO-ACOUSTIC UNIQUE TEST CAPABILITIES (FREE-FLIGHT TESTS)



UPPER-SURFACE BLOWING



SUPERSONIC AIRCRAFT AT LOW SPEED

FIGURE 3

LANGLEY RESEARCH CENTER
FISCAL YEAR 1984 ESTIMATES
MODIFICATIONS TO 30- BY 60-FOOT TUNNEL (64ℨ)

PROPOSED MODEL SUPPORT AND BALANCE SYSTEM

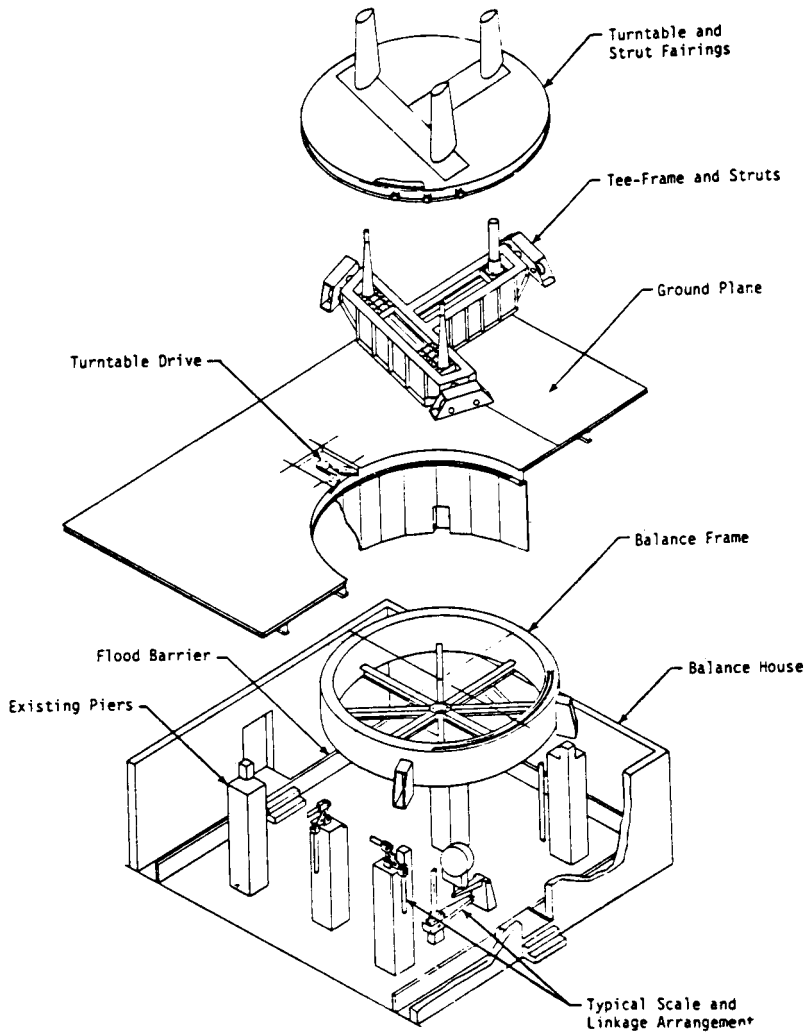


FIGURE 4

LANGLEY RESEARCH CENTER
FISCAL YEAR 1984 ESTIMATES
MODIFICATIONS TO 30- BY 60-FOOT TUNNEL (643)

FREE-FLIGHT MODEL

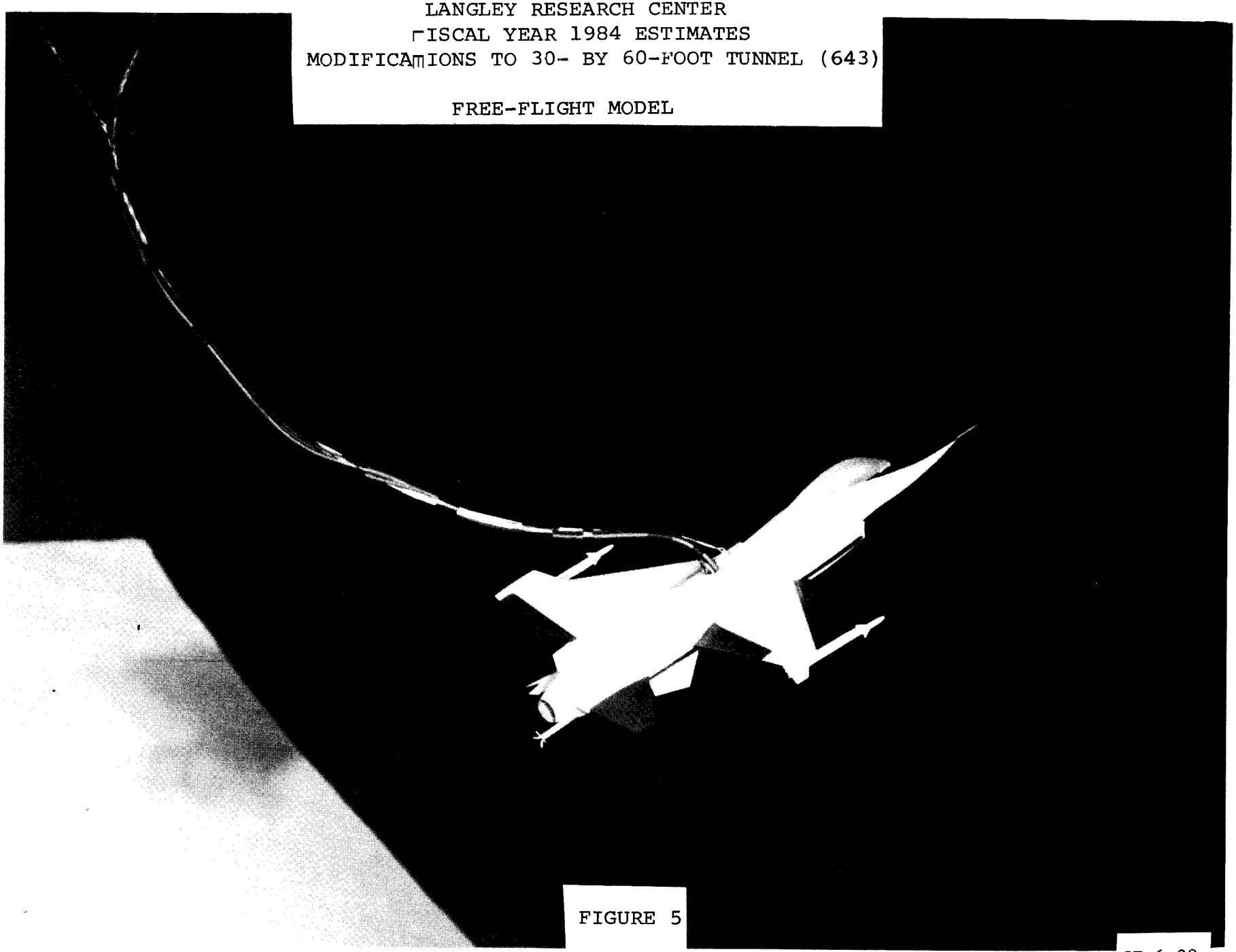


FIGURE 5

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1984 ESTIMATES

SUMMARY

LEWIS RESEARCH CENTER

	Amount	Page No.
Office of Aeronautics and Space Technology:		
Modifications for Small Engine Component Testing Facility..	7,000,000	CF 7-1
Modifications to Icing Research Tunnel,.....	3,600,000	CF 7-11
Total.....	10,600,000	

LEWIS RESEARCH CENTER
FISCAL YEAR 1984 ESTIMATES
MODIFICATIONS FOR SMALL ENGINE COMPONENT TESTING FACILITY

LOCATION PLAN

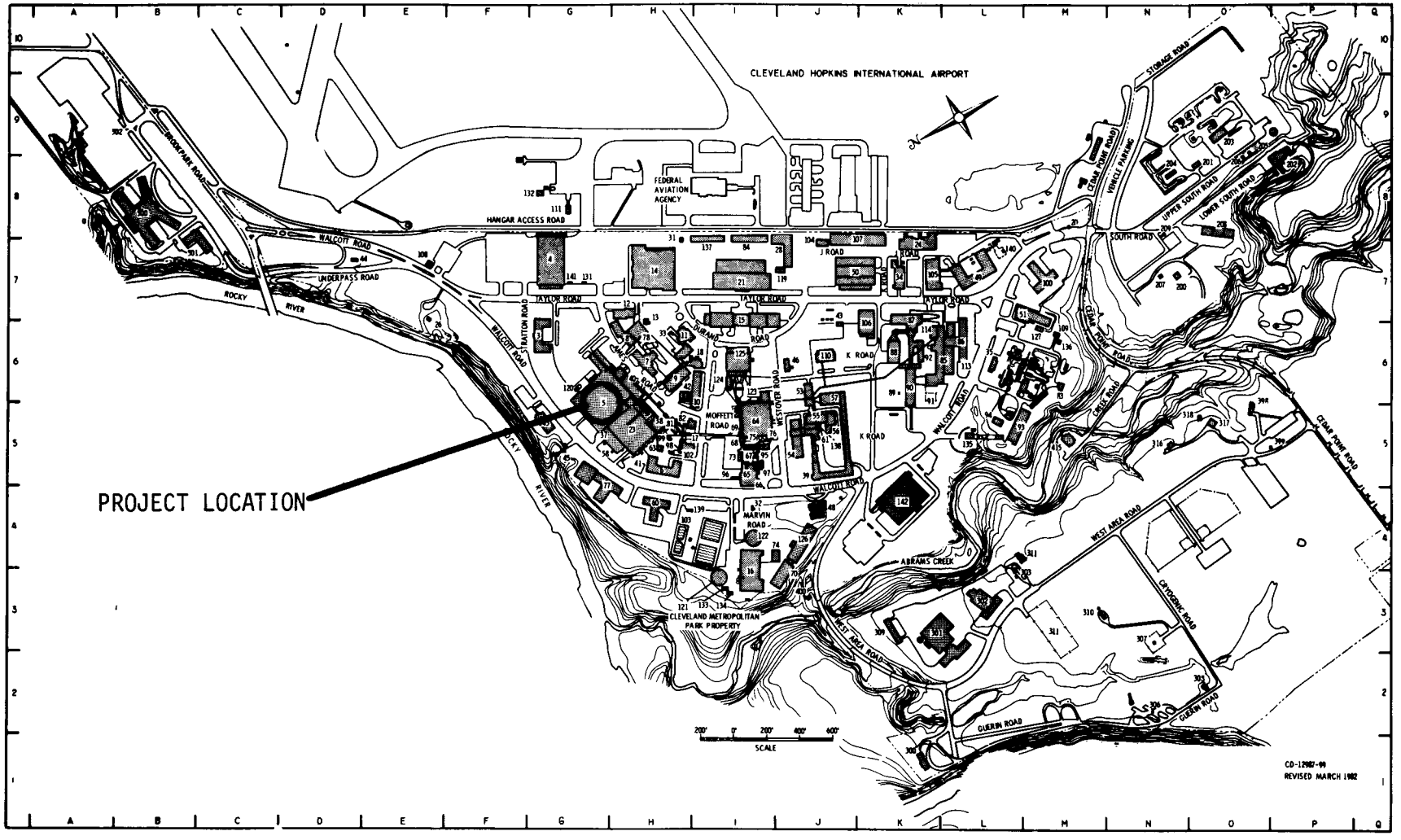


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1984 ESTIMATES

PROJECT TITLE: Modifications for Small Engine Component Testing Facility

INSTALLATION: Lewis Research Center

FY 1984 CoF ESTIMATE: $7,000,000

LOCATION OF PROJECT: Cleveland, Cuyahoga County, Ohio

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology

FY 1983 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	557,000	---	557,000
Capitalized investment	N/A	13,305,000	13,305,000
Total	557,000	13,305,000	13,862,000

SUMMARY PURPOSE AND SCOPE:

This project provides for modification of Building 5 of the Engine Research Building Complex at the Lewis Research Center (LeRC) for research testing of small gas turbine engine compressors and turbines (Figure 1). This research testing is required to improve overall performance of small gas turbine engines which are used for an increasing variety of aircraft and ground power applications. The nonlinear nature of turbine engine fluid and structural mechanics makes scaled down large component research data inaccurate for small gas turbine engine application. As an example, test data on blade clearances, surface finishes, and edge thicknesses cannot be scaled down from the data available on large components.

Test cell CE-18 in Building 5 will be modified for small engine compressor testing. A mezzanine test control room will be added to the existing single level test control room located within the high bay area of CE-20 (Figure 2). Equipment for testing small engine compressors at simulated engine operating conditions will also be installed.

A portion of test cell CE-17, in Building 5, will be modified for small engine turbine testing. Adjacent room CE-15 will be modified for control room use (Figure 2). Equipment required for testing small engine turbines at simulated engine operating conditions will also be installed.

PROJECT JUSTIFICATION:

The expanding role of small gas turbine engines makes efficiency improvements increasingly more important. These engines, which typically have up to 5,000 pounds (22,400 Newtons) thrust or 2,000 shaft horsepower (1,492 kilowatts), are used in rotorcraft, small fixed-wing general aviation aircraft, cruise missiles, trucks and buses, and for other ground power applications. The test capabilities provided by this project are essential to the development of advanced, higher efficiency small gas turbine engines.

Difficult geometric problems such as compressor and turbine blade clearances, surface finishes, and leading and trailing edge thicknesses in these small engines, have kept their performance and efficiency substantially lower than that of larger engines. Planned research efforts are being directed to solving these problems and also to reducing exhaust pollutants. Such improvements can be significant contributors to the Nation's energy conservation and environmental protection efforts, as well asmaintaining world-wide aeropropulsion preeminence.

Existing test capabilities of industry and NASA do not provide the range of test conditions needed to satisfy Small engine component research requirements. These requirements include research compressor outlet and inlet pressures of up to 750 pounds per square inch (517 Newtons per square centimeter), temperatures up to 1,300°F (705°C), and air flows up to 13 pounds per second (5.9 kilograms per second). The turbine test facility requirements include pressures to 125 pounds per square inch (88 Newtons per square centimeter), temperatures up to 8000F (427°C), and air flows up to 8 pounds per second (3.6 kilograms per second).

Compressor testing equipment at LeRC does not provide the full range of operating conditions needed to conduct comprehensive small engine compressor research. This project will provide the test capability of up to 60,000 revolutions per minute and power up to 6,000 horsepower (4,500 kilowatts) to meet research requirements for small engine compressor testing.

Existing turbine facilities are also inadequate because only overall performance data can be obtained while detailed internal flow and studies of the ratios of actual turbine inlet to coolant temperatures cannot be

measured. This project will provide the necessary test capability of up to 60,000 revolutions per minute and power up to 1,200 horsepower (0.900 kilowatts) to meet research requirements for small engine turbine testing.

No comparable facility exists within NASA, other Government agencies, or industry. This project is essential to NASA's small gas turbine engine component research for both present engines and future high pressure ratio engines.

IMPACT OF DELAY:

The existing compressor/turbine test facilities at LeRC do not have sufficient capability to meet the research requirements of the 1986–1990 time frame. Delay in providing this research and test facility will introduce further serious delays in small turbine engine research.

PROJECT DESCRIPTION:

This project provides for modifications to Building 5 of the Engine Research Building Complex. It includes architectural/structural, mechanical, and electrical modifications and the installation of the necessary equipment for testing compressors (Figure 3). Test cell CE–18, 2,415 square feet (225 square meters), will be modified for this testing and mezzanine area CE–20, 437 square feet (40 square meters), will be modified for control room use. The work includes installation of a 4–ton (3,632 kilogram) bridge crane in Room CE–18 and the general rehabilitation of the interior surfaces. A new heating, ventilating, and air–conditioning (HVAC) system will be installed in the test cell and in the test control room. The equipment to be installed for testing compressors includes a two–source inlet air supply piping system. One source will be atmospheric air for simulating turbojet engine compressor inlet conditions. The other source will be compressed air at 40 pounds per square inch (27.6 Newtons per square centimeter) for simulating turbofan engine compressor inlet conditions. Discharge piping includes a collector vessel to receive air from the research compressor, a back pressure control valve, and a spray cooler to cool the compressor discharge gases. A new 6,000 horsepower (4,476 kilowatt) electric motor will drive the research compressor through a gear box to attain compressor speeds up to 60,000 revolutions per minute. Also included are facility operation, instrumentation, and control systems.

The project also provides for architectural/structural, mechanical, electrical modifications and the installation of the necessary equipment for testing small gas turbines (Figure 4). A portion of test cell CE–17, 667 square feet (62 square meters), will be modified and Room CE–15, 266 square feet (25 square meters), will be modified for control room use. The walls, floors, ceilings, and door of the test cell will be rehabilitated or modified as required to meet functional requirements and safety standards. HVAC and other mechanical systems will be installed in the test cells. Electric power will be provided for the new equipment

to be installed in the test cell and the test control room. The turbine facility will consist of a combustor, a research turbine, a 1,200 horsepower dynamometer, throttle and load valves, related piping, cooling, and safety systems. Facility operation instrumentation and control systems are also included.

PROJECT COST ESTIMATE:

The project cost estimate is based on a completed preliminary engineering report.

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition	---	---	---	---
Construction	---	---	---	984,000
Building modifications for compressor facility	---	---	---	512,000
Architectural/structural	LS	---	---	(141,000)
Mechanical	LS	---	---	(133,000)
Electrical	LS	---	---	(238,000)
Building modifications for turbine facility	---	---	---	472,000
Architectural/structural	LS	---	---	(55,000)
Mechanical	LS	---	---	(163,000)
Electrical	LS	---	---	(254,000)
Equipment	---	---	---	6,016,000
Compressor facility	---	---	---	2,673,000
Inlet air system	LS	---	---	(508,000)
Exhaust system	LS	---	---	(146,000)
Cooling water system	LS	---	---	(44,000)
Dewatering system	LS	---	---	(31,000)
Nitrogen system	LS	---	---	(59,000)
Drive system	LS	---	---	(1,296,000)
Instrumentation and control system	LS	---	---	(589,000)
Turbine facility	---	---	---	3,343,000
Compressed air system	LS	---	---	(172,000)
Fuel supply system	LS	---	---	(78,000)
Air heating system	LS	---	---	(146,000)
Cooling water system	LS	---	---	(90,000)

	Unit of Measure	Quantity	Unit cost	cost
Cooling air system	LS	---	---	(23,000)
Exhaust system	LS	---	---	(232,000)
Power absorber system	LS	---	---	(1,789,000)
Instrumentation and control systems	LS	---	---	(813,000)
Fallout Shelter (not feasible)	---	---	---	---
Total				7,000,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Site Plan
Figure 3 - Schematic Drawing, Modifications for Compressor Test Facility
Figure 4 - Schematic Drawing, Modifications for Turbine Test Facility

OTHER EQUIPMENT SUMMARY:

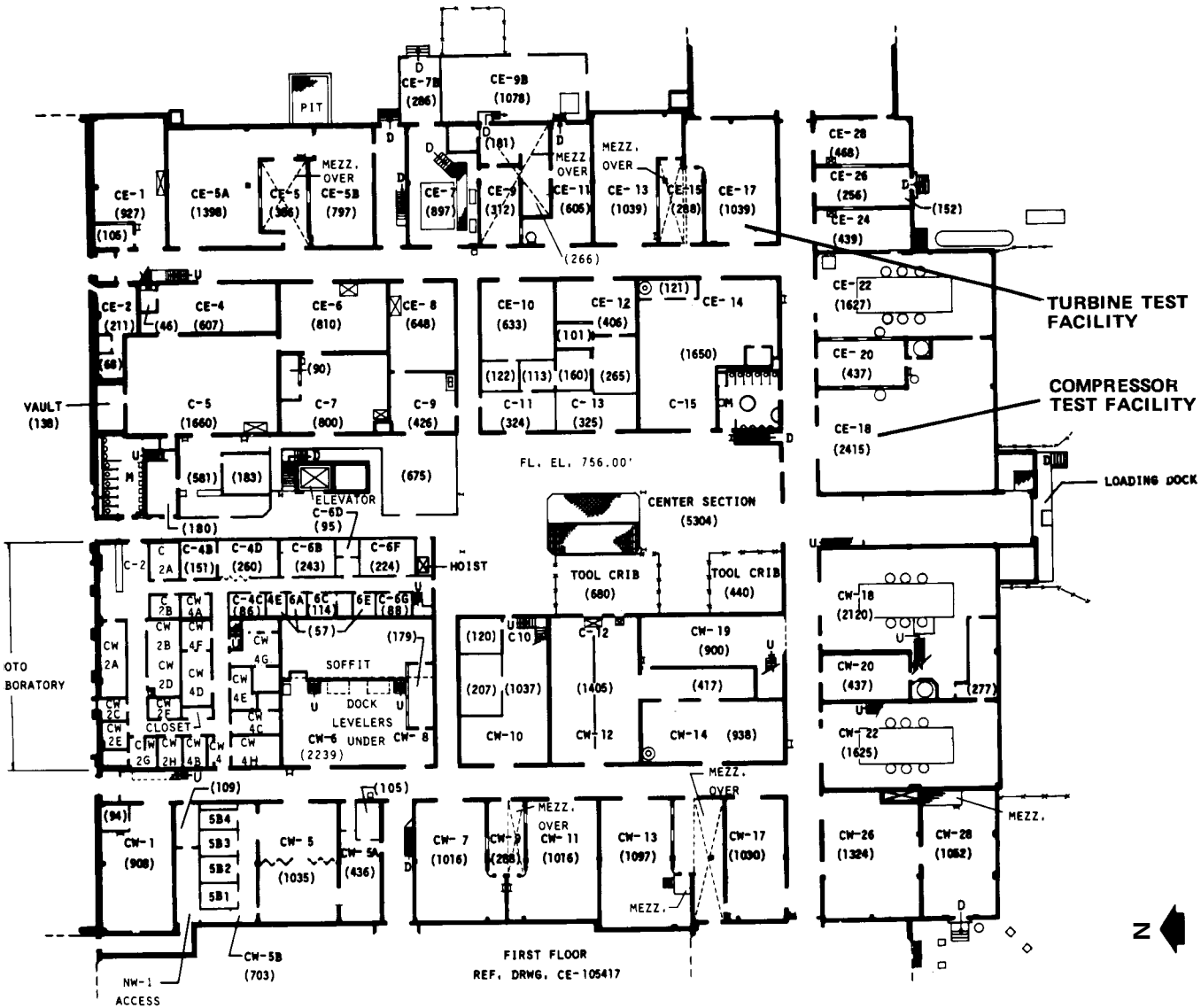
A research compressor and turbine, and data aquisition system costing approximatly $3.4 million are required for initial operation of this facility and will be funded with Research and Development resources.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No additional CoF funds are required to complete this project. However, a follow-on project is planned which is currently estimated at $8.7M and will provide a small engine combustor testing capability.

LEWIS RESEARCH CENTER
FISCAL YEAR 1984 ESTIMATES
MODIFICATIONS FOR SMALL ENGINE COMPONENT TESTING FACILITY

SITE PLAN



ENGINE RESEARCH BUILDING 5

CF 7-8

FIGURE 2

LEWIS RESEARCH CENTER
FISCAL YEAR 1984 ESTIMATES
MODIFICATIONS FOR SMALL ENGINE COMPONENT TESTING FACILITY

SCHEMATIC DRAWING
MODIFICATIONS FOR COMPRESSOR TEST FACILITY

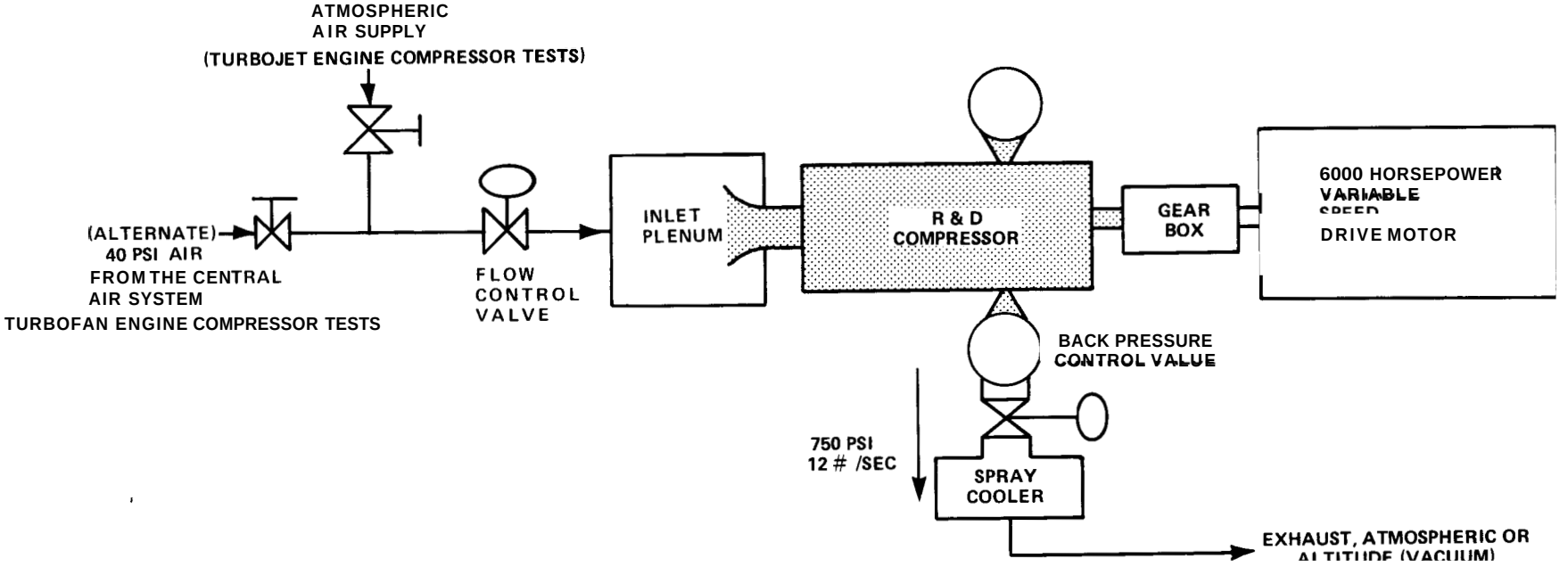


FIGURE 3

LEWIS RESEARCH CENTER
FISCAL YEAR 1984 ESTIMATES
MODIFICATIONS FOR SMALL ENGINE COMPONENT TESTING FACILITY

SCHEMATIC DRAWING
MODIFICATIONS FOR **TURBINE** TEST FACILITY

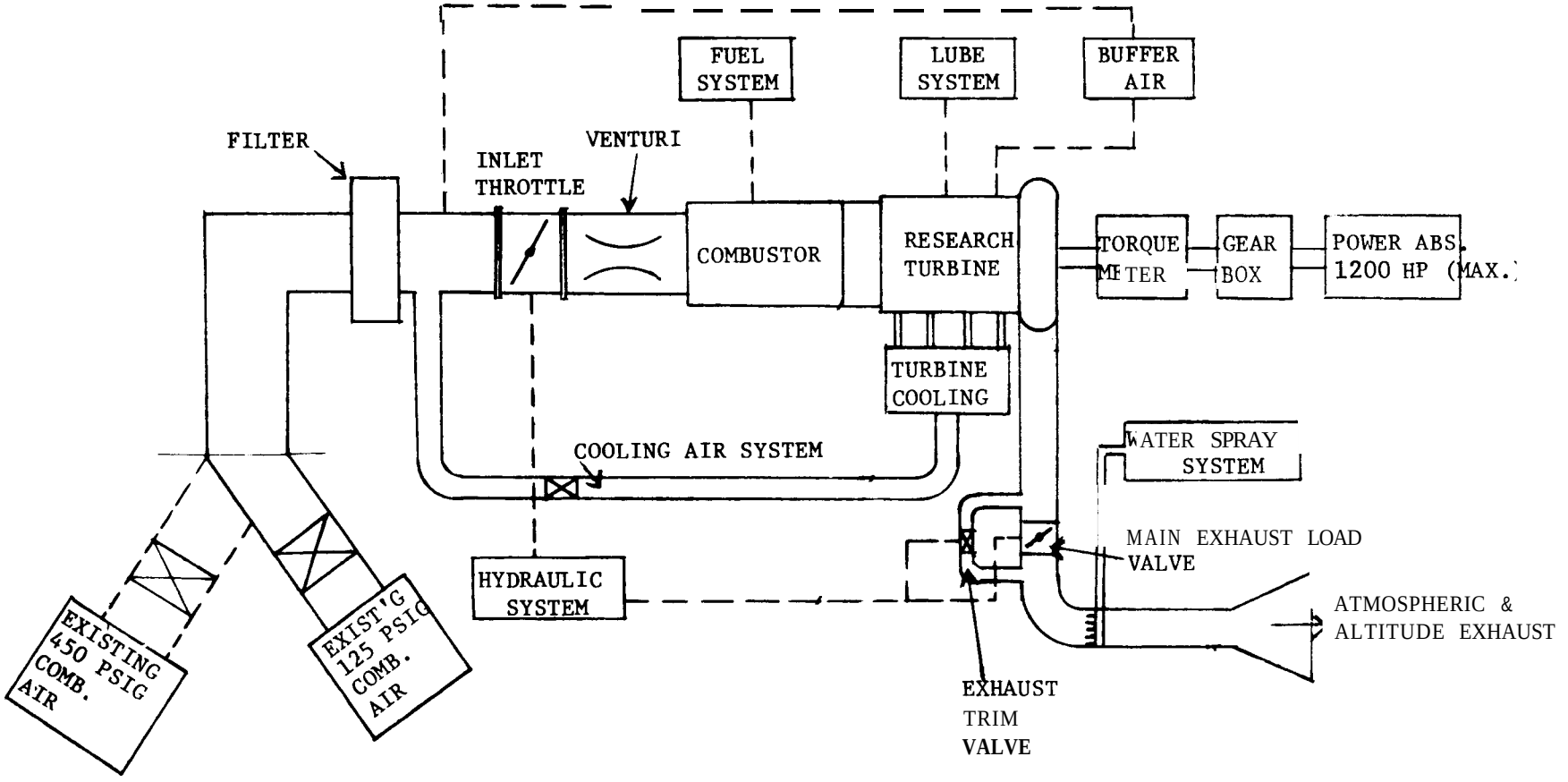


FIGURE 4

LEWIS RESEARCH CENTER
FISCAL YEAR 1984 ESTIMATES
MODIFICATIONS TO ICING RESEARCH TUNNEL **(11)**

LOCATION PLAN

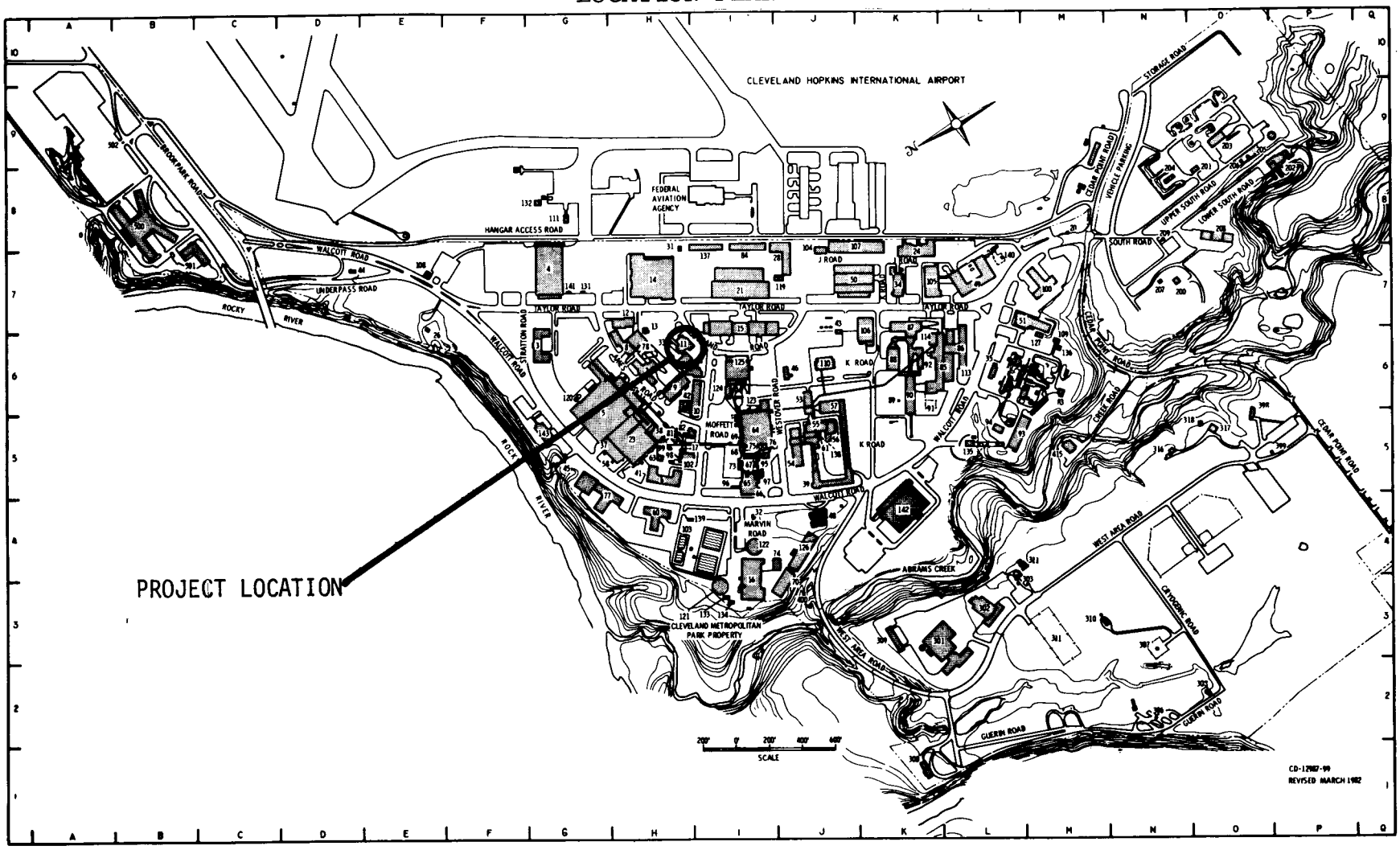


FIGURE 1

CF 7-11

PROJECT TITLE:	Modifications to Icing Research Tunnel (11)
INSTALLATION:	Lewis Research Center
	FY 1984 CoF ESTIMATE: $3,600,000

LOCATION OF PROJECT: Cleveland, Cuyahoga County, Ohio

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology

FY 1983 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding..	252,000	---	252,000
Capitalized investment	N/A	1,015,000	1,015,000
Total	252,000	1,015,000	1,267,000

SUMMARY PURPOSE AND SCOPE:

This project provides for modifications to the Icing Research Tunnel (IRT), Building 11, at the Lewis Research Center (LeRC). The facility, constructed in 1944, is used for conducting basic icing research, and the development of deicing/anti-icing systems (Figure 1). This project is required to ensure that the reliability and capability of this 40-year old tunnel is maintained and enhanced to meet present requirements.

The need for additional icing research data for all-weather helicopter, military aircraft operations, and low-flying cruise missiles has increased the use of the tunnel, and has focused attention on the need for

improved icing test capabilities. These modifications provide for upgrading the tunnel utilities, test chamber, and office-shop building to provide a wider range of test conditions, improved control of tunnel operating conditions, and more efficient tunnel operation. Also, the quality and research value of the data will be improved by enhancing the realism of the test conditions.

PROJECT JUSTIFICATION:

The IRT is the largest icing tunnel in the United States and the only tunnel capable of testing selected full-scale components to meet critical needs of civiiian and military aircraft development programs. The tunnel is heavily utilized and has a 2-year testing backlog. The only alternative to the study of icing in a tunnel is costly in-flight testing. Basic icing research, new deicing systems development, and many new aircraft designs requiring deicing systems will continue to demand use of this IRT.

Typical research programs using the IRT are: Aviation Meteorology Research, Advanced Rotorcraft Propulsion Technology, and Interagency/Industrial Assistance. These programs relate to the safe operation of aircraft in atmospheric icing conditions, and the study of icing accretion and resultant aerodynamic penalties on rotorblades and crafts.

Recent studies have shown a greater need for icing research in support of commercial, general aviation, and military aircraft. Special testing for rotor craft and low-flying cruise missiles is also required to develop lightweight, cost-effective ice protection systems. Electrothermal ice protection for helicopter rotor blades is effective, but introduces as much as 20 percent payload penalty for the required electrical generating equipment. The development of new systems for helicopter rotors is complicated by high tip speeds and the affects of centrifugal forces. Low-flying cruise missiles require ice accretion test environments for design of all-weather guidance systems. Advanced ice protection systems that do not adversely affect performance and payload are needed for military all-weather aircraft operations. These needs have resulted in expanding research efforts by NASA, DOD, and FAA. The IRT at LeRC is a critical facility for meeting these icing research needs, now and in the future.

This project is required to ensure that the reliability of this 40-year old tunnel is enhanced to support icing research requirements. Reliability will be improved by replacing the tunnel fan drive motor and controls, and exhaust air controls with new components; providing improved mechanical systems for cloud formation, and a new control room. In addition, productivity will be improved to help relieve the backlog of scheduled tests. A new water spray bar control will provide a wider range of water content and droplet size to improve realism of the tunnel icing cloud.

IMPACT OF DELAY:

A new generation of improved deicing/anti-icing systems is needed in the near future for general aviation, helicopters, and military aircraft, and can best be developed through testing in the IRT. The impact of delaying the modification of this facility would be late development of the icing technology. This project also ensures that this 40-year old tunnel will operate satisfactorily in the future without major breakdowns. A major breakdown would cause serious delays because the availability of replacement parts is uncertain. For example, the tunnel was recently shut down from April through June 1982 due to a failure of the tunnel fan motor controls.

PROJECT DESCRIPTION:

This project provides for the upgrading of the IRT by rehabilitating and modifying the office-shop building, test chamber, and the tunnel utilities/process systems (Figure 2). The work for the office-shop buildings will involve rehabilitation of the building envelope. The existing single-glazed wood windows will be replaced with dual-glazed aluminum windows. The exterior masonry surfaces will be repaired, tuck-pointed, and sealed. A new roof will be provided over the office and shop. The heating, ventilating, and air-conditioning (HVAC) system will be changed from the 40-year old freon compressor and coil to a new chilled water coil with automatic controls. The building power distribution system will be replaced by modern transfer switch and power lighting panels.

Test chamber work involves modernization of the chamber's internal structure, HVAC system, electrical system, and tunnel control room. Existing wood floor framing, wood flooring, walls, ladders, and stairways will be removed. The floors will be rebuilt using steel framing and metal deck/concrete flooring. A new control room with air lock and passageway for safe exit to the outside will be constructed. The control room will also include new instrument and control cabinets and a new power panel. The existing crane rail and supports for equipment handling will be relocated for better alignment over the top of the tunnel test section. The existing power distribution system including transfer switch, power panels, lighting panels, and wiring will be replaced with modern equipment and wiring.

The project work for the tunnel utility systems includes modernizing tunnel air flow control, air temperature control, icing cloud formation control, and exhaust air control and measurement; and replacing and updating the piping and controls for steam, air, and water services to the icing cloud spray nozzle systems. New refrigerant flow and temperature controls will be provided. A new 5,000 horsepower drive motor and solid state controls for the tunnel air fan will be installed. An orifice and valve positioner for the tunnel exhaust air system will be furnished.

PROJECT COST ESTIMATE:

The project cost estimate is based on a preliminary engineering report.

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition	---	---	---	---
Construction	---	---	---	893,000
Office-shop	LS	---	---	251,000
Test cell	LS	---	---	642,000
Equipment	---	---	---	2,707,000
Spray bar system	LS	---	---	307,000
Tunnel temperature control	LS	---	---	120,000
Exhaust air system	LS	---	---	102,000
Tunnel fan motor and controls	LS	---	---	1,894,000
Instrumentation and controls	LS	---	---	284,000
Fallout Shelter (not feasible)	---	---	---	---
Total				3,600,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Plan View, Icing Research Tunnel

OTHER EQUIPMENT SUMMARY:

A force balance system and special spray nozzles, costing approximately $500,000, are required for operation of this facility and will be funded from Research and Development resources.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

There is no foreseen requirement for future CoF funding for this project.

LEWIS RESEARCH CENTER
FISCAL YEAR 1984 ESTIMATES
MODIFICATIONS TO ICING RESEARCH TUNNEL (11)

PLAN VIEW - ICING RESEARCH TUNNEL

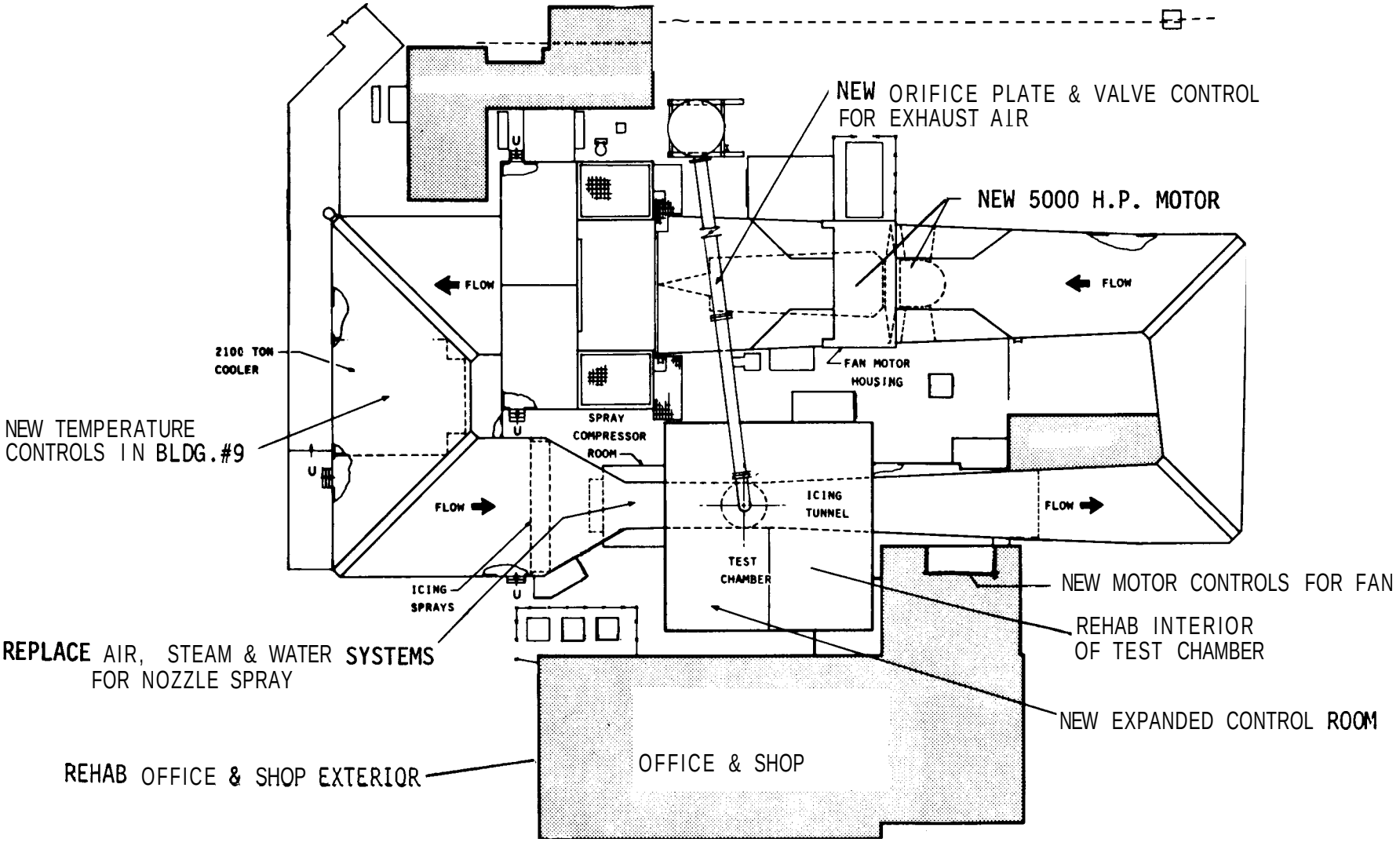


FIGURE 2

VARIOUS
LOCATIONS

[redacted]

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1984 ESTIMATES

SUMMARY

VARIOUS LOCATIONS

	Amount	Page No.
Office of Space Tracking and Data Systems:		
Relocation of 26-Meter STDN Antenna, Spain	1,700,000	CF 8-1

VARIOUS LOCATIONS
FISCAL YEAR 1984 ESTIMATES
RELOCATION OF 26-METER STDN ANTENNA, SPAIN

LOCATION PLAN

FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1984 ESTIMATES

PROJECT TITLE: Relocation of 26-Meter STDN Antenna, Spain

INSTALLATION: Jet Propulsion Laboratory

FY 1984 CoF ESTIMATE: $1,700,000

LOCATION OF PROJECT: Robledo, Spain

COGNIZANT HEADQUARTERS OFFICE: Office of Space Tracking and Data Systems

FY 1983 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	130,000	---	130,000
Capitalized investment	N/A	750,000	750,000
Total	130,000	750,000	880,000

SUMMARY PURPOSE AND SCOPE:

This project relocates the 26-meter Spaceflight Tracking and Data Network (STDN) antenna from Fresnedillas, Spain, to the main Deep Space Network (DSN) complex in Robledo, Spain (Figures 1 and 2). This is part of the plan to consolidate all required antenna facilities in the Madrid, Spain area at one central location. The consolidation will allow closure of the remote STDN station at Fresnedillas, Spain and realize an operational savings of $2.5 million annually. Similar consolidations of antenna facilities are planned at the other DSN complexes.

PROJECT JUSTIFICATION:

The new Tracking and Data Relay Satellite System (TDRSS) will provide most of the earth-orbital spacecraft tracking and data support when operational. The DSN will continue to be configured to provide support to planetary exploration spacecraft. However, certain earth-orbital missions, such as spacecraft in highly ellipitical or geosynchronous orbits, cannot be supported by TDRSS. These spacecraft missions will continue to use ground-based antenna systems. Also required is an emergency back-up support capability for spacecraft, such as TDRSS and the Space Shuttle, and Space Telescope. Relocation of the Fresnedillas 26-meter STDN earth orbital support antenna to the Robledo, Spain, DSN location will provide the necessary support and also enable closure of the Fresnedillas STDN station. This relocation will result in an estimated $2.5 million annual operational savings for a payback of less than 1 year.

IMPACT OF DELAY:

Delay of this project would postpone relocation of this antenna, the planned closure of the Fresnedillas STDN station, and the associated $2.5 million annual operational savings by at least 2 years due to the Voyager-Uranus encounter. This relocation must be accomplished in FY 1984 to accommodate the peak activity period at the Robledo DSN complex in 1985 associated with the Voyager-Uranus encounter.

PROJECT DESCRIPTION:

The 26-meter STDN antenna (Figure 3) in Spain will be relocated (without modification) from Fresnedillas, Spain, to the main DSN complex in Robledo, Spain. Site development work includes grading, drainage, paving, and a new antenna foundation. A new antenna systems enclosure, electric power, cable trays, and mechanical and safety systems will also be provided.

PROJECT COST ESTIMATE:

The cost is based on preliminary engineering and related studies.

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition	---	---	---	---
Construction	---	---	---	1.700.000
Antenna relocation	LS	---	---	1,000,000
Grading, paving, and drainage	LS	---	---	50,000
Antenna foundation	LS	---	---	210,000
Antenna support systems enclosure	LS	---	---	140,000
Electrical power and cable trays	LS	---	---	190,000
Mechanical and safety systems	LS	---	---	110,000
Equipment	---	---	---	---
Fallout Shelter (not feasible)	---	---	---	---
Total				1,700,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan, Madrid, Spain
Figure 2 - Site Plan, Robledo Complex
Figure 3 - 26-Meter STDN Antenna

OTHER EQUIPMENT SUMMARY:

Electronic equipment and related engineering support will be provided from Research and Development (R&D) funds in the amount of $600,000. Included is the relocation of approximately $8 million of existing R&D electronic equipment from the STDN station in Fresnedillas, Spain.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No future CoF funding is required to complete this project.

VARIOUS LOCATIONS
FISCAL YEAR 1984 ESTIMATES
RELOCATION OF 26–METER STDN ANTENNA, SPAIN

SITE PLAN

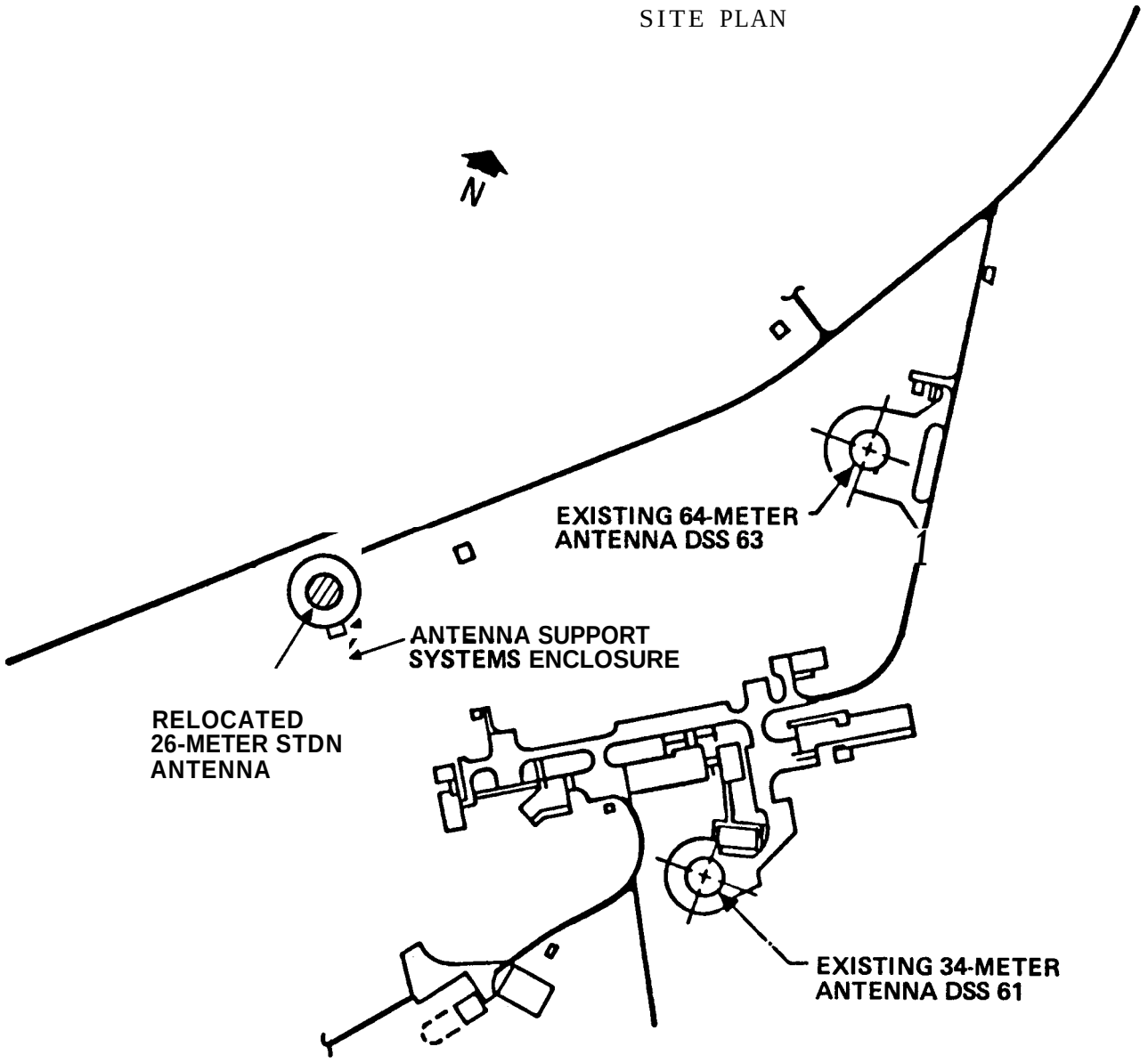


FIGURE 2

VARIOUS LOCATIONS
FISCAL YEAR 1984 ESTIMATES
RELOCATION OF 26-METER STDN ANTENNA, SPAIN

26-METER STDN ANTENNA

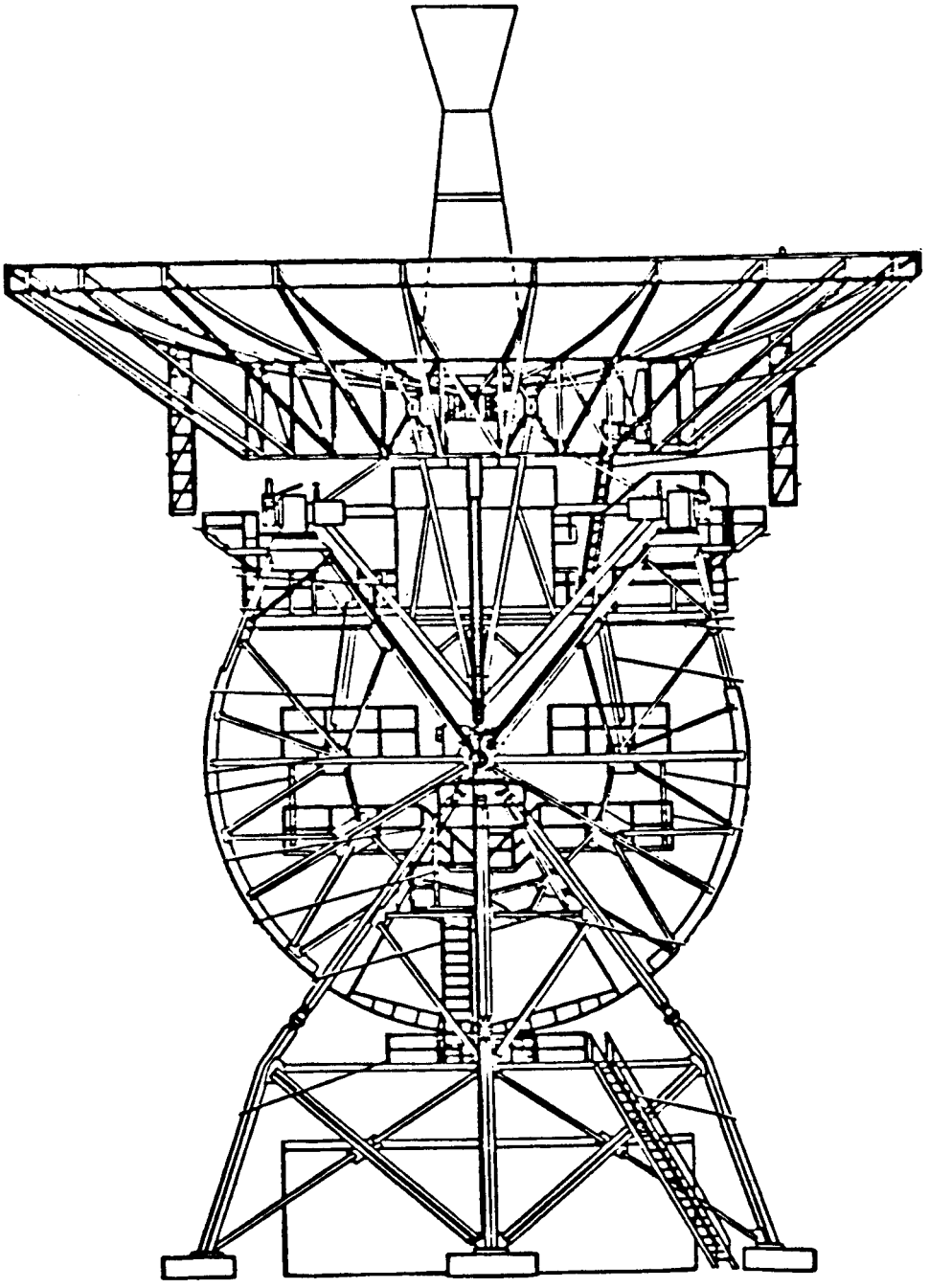


FIGURE 3

REPAIR

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1984 ESTIMATES

SUMMARY

REPAIR

Summary of Project Amounts by Location:	Amount	Page No.
Ames Research Center	1,395,000	CF 9-3
Dryden Flight Research Center	425.000	CF 9-4
Goddard Space Flight Center	1.690.000	CF 9-4
Jet Propulsion Laboratory	1.740.000	CF 9-6
Johnson Space Center	1.440.000	CF 9-7
Kennedy Space Center	410.000	CF 9-9
Langley Research Center	3,310,000	CF 9-9
Lewis Research Center	2.280.000	CF 9-11
Marshall Space Flight Center	2.265.000	CF 9-13
Michoud Assembly Facility	1.765.000	CF 9-15
National Space Technology Laboratories	1.525.000	CF 9-16
Wallops Flight Facility	230.000	CF 9-18
Various Locations	680.000	CF 9-18
Miscellaneous Projects Not Exceeding $150,000 Each	345.000	CF 9-19
Total	19.500.000	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1984 ESTIMATES

PROJECT TITLE:	Repair of Facilities, Not In Excess Of $500,000 Per Project	
INSTALLATION:	Various Locations	
	FY 1984 CoF ESTIMATE:	$19,500,000
FY 1982: $12,800,000		FY 1983: $14,000,000

COGNIZANT INSTALLATIONS/LOCATION OF PROJECT: Various Locations

COGNIZANT HEADQUARTERS OFFICE: Office of Management

SUMMARY PURPOSE AND SCOPE:

These resources will provide for large repairs to facilities at NASA field installations and Government-owned industrial plants supporting NASA activities. Included in the request are those facility repair needs for FY 1984 that can be foreseen at the time of the submission of these estimates, and that are estimated not to exceed $500,000 per project. The thrust of this program is to provide a means to restore facilities or components thereof, including collateral equipment, to a condition substantially equivalent to their originally intended and designed capability. The request includes the substantially equivalent replacement of utility systems and collateral equipment necessitated by incipient or actual breakdown. This work also includes major preventive measures which are normally accomplished on a cyclic schedule of greater than 1 year.

PROJECT JUSTIFICATION:

A major portion of the Agency's buildings exceeds 15 years in age, and increases in repair requirements are to be expected. Maintenance and repair costs for mechanical and electrical systems in a typical building are almost three times higher during the 16- to 30-year period of a building's life than they are during the initial

15 years of beneficial occupancy. At about the 15-year point, many electrical and mechanical components reach the end of their serviceable or economic life and should be replaced in the interest of long-term economy. Continued piecemeal repair of these components usually requires more resources in the long run than replacement after the end of the economic life of the original components. This condition is now being encountered at locations such as Goddard Space Flight Center (GSFC) and Johnson Space Center (JSC). The age of other portions of the NASA plant, such as facilities at Langley Research Center (LaRC) and Lewis Research Center (LeRC), highlights the need for an aggressive repair program. Some 75 percent of the physical plant is in the 16- to 30-year old category.

The major thrust of this repair program, as well as the rehabilitation and modification program, is to preserve the Agency's $7.7 billion (as of September 30, 1982) capital type property of which the physical plant comprises some $3.2 billion. The major distinction between these classes of work is whether or not the intended work is to bring the facility and its components to a condition substantially equivalent to its designed capacity, efficiency, and capabilities. If such is the case, the work is classified as repair. An analysis of each of the projects for which funds are requested indicates that this work must be addressed and progressively accomplished. Otherwise, risks are increased and future costs of the specific work will be greater. More importantly, there will be increased breakdowns and costly emergency repairs required.

This program includes only facility repair work having an estimated cost not in excess of $500,000 per project. The work is of such a nature and magnitude that it cannot be accomplished by routine day-to-day facility maintenance and repair activities, or by related routine facility work efforts that are provided for in other than CoF estimates. Each repair project, estimated to cost more than $500,000, is reflected elsewhere as a separate major line item project.

PROJECT DESCRIPTION:

Proposed repair projects for FY 1984 totaling $19,500,000 are described under "PROJECT COST ESTIMATE."! Projects estimated to cost not in excess of $150,000 have not been individually described or identified by Center, and the total estimate for these projects is $345,000. This repair program has been distilled from requests for FY 1984 exceeding $25,800,000, and thus represents a modest request in relation to the continuing backlog of this type of work. Based on relative urgency and expected return on investment, the projects which comprise this request are of the highest priority. Deferral of this mission-essential work would adversely impact the availability of critical facilities and program schedules.

During the course of the year, it is recognized that some rearrangement of priority may be necessary. This may force a change in some of the items to be accomplished. Any such change, however, will be accomplished within available resources. The following broad categories of work are described further in the "PROJECT COST ESTIMATE":

a.	Utility Systems..	9,320,000
b.	General Purpose Buildings	1,255,000
c.	Technical Buildings/Structures	5,550,000
d.	Pavements and Drainage	1,295,000
e.	Building Exteriors and Roofs	2,080,000

PROJECT COST ESTIMATE:

A.	Ames Research Center (ARC)	1,395,000
1.	Repair 6-Foot by 6-Foot Wind Tunnel Cooling Tower	475,000

This large, 35-year old cooling tower requires extensive mechanical and structural repair to allow continued reliable operation of the 6-foot by 6-foot (1.8 meter by 1.8 meter) wind tunnel. The project includes replacing and/or repairing structural components as necessary, replacing the fan deck and fan motor structure, rebuilding the flume, and replacing the fill supports. Wooden fill will be replaced with a plastic fill, thereby eliminating clogs in the water cooling system due to splintered fill. Tower fans are heavy, require excessive power, and vibrate due to imbalance as a result of age. They will be replaced, and accessories and support equipment repaired as necessary.

2.	Repair of High Pressure Air Systems	435,000

This project is a continuation of repairs begun in FY 1983. During recertification of pressure systems at ARC, numerous discrepancies were found in this system. Extensive nondestructive testing, pipe replacement, and rewelding are required for code conformance. Some valve replacement, repair, and addition of pipe supports and anchors are also required. Failure to correct these safety deficiencies will adversely affect the operation of the Unitary Plan Wind Tunnels, the 7-foot by 10-foot (2.1 meter by 3 meter) Wind Tunnel, and several other important research facilities served by the high-pressure air system.

3. Repair of 20 Megawatt Semielliptical Duct Nozzles..... 265,000

This facility operates at Mach 3.5, and up to 2,700°F (1,480°C) to test heat shield systems and materials. The two interchangeable water-cooled nozzles which eject the hot gases onto the test sample are about 10 years old, and are subject to very high stresses. Both have required numerous repairs to the water cooling system because of the age of the units. Heat stresses have caused waviness in the nozzles, which causes a nonuniform gas flow and erratic test results. This project will provide a new nozzle and throat section with improved water cooling design.

4. Repair of Roads and Streets..... 220,000

This project will provide 17,000 square yards (14,220 square meters) of asphaltic concrete overlay and other associated repairs to two 35-year old roads at ARC. Both roads have deteriorated to the point that the surface is spalled and cracked, and rain water can penetrate and soften the base material. Failure to accomplish these repairs will lead to failure of the roadway, which would require replacement of the entire surface and base courses at a much higher cost than timely repairs.

B. Dryden Flight Research Facility (DFRF)..... 425,000

Repair Electrical Feeders and Substation..... 425,000

A 750-foot (230 meter) long 12,000 volt electric feeder and associated substation provides power from Edwards Air Force Base to DFRF. It was installed in 1953. Repeated stresses from lightning surges and water immersion have made the lead-sheathed, paper-insulated cable subject to sudden and catastrophic failure which cuts off power to Substation No. 1, and thus to half of the DFRF complex. The substation switchgear was fabricated by a company which has been out of business for more than 25 years and rebuilt parts can no longer be obtained. The switchgear does not meet the requirements of the current National Electric Codes. The equipment presents potential hazards due to arcing, ground fault interference, or other breakdown. This project will repair the power feeders and station equipment, and will replace unavailable components with new equipment.

C. Goddard Space Flight Center (GSFC)..... 1,690,000

1. Repair Electrical System, Payload Testing Facility (7)..... 350,000

This project provides for the replacement of four main breakers and two tie-breakers for the switchgear in the basement electric equipment room of the Payload Testing Facility (7). The main breakers were installed in 1961 as part of the original building electrical equipment. Now, due to the worn condition of the spring

force retention parts of each main breaker, they have a tendency to close without manual activation during reset, creating a dangerous condition for maintenance personnel. In addition, maintenance will become increasingly difficult because the breaker manufacturer has ceased production of replacement parts. Also included in this project is the replacement of the two manual tie-in switching systems with fully automatic transfer switching systems. This replacement will provide automatic redundancy for interruption-free service to the ongoing spacecraft and spacecraft component tests in the numerous thermal vacuum chambers. This project will result in enhancement of the overall electrical system reliability and reduction in maintenance costs.

2. Repair Electrical Feeders Between Buildings 24 and 3/13/14 180,000

This project provides for the replacement of approximtely 18,000 linear feet (5,487 linear meters) of 350 MCM cross-linked polyethylene, 4,160 volt electrical feeder sections with ethylene-propolene rubber feeder between Buildings 24 and 3/13/14. These feeders supply the normal and emergency electrical power to the Central Flight Control and Range Operations Building (3), Network Operations Control Center (13), Spacecraft Operations Facility (14) complex from the substation and the diesel generators in the Central Heating and Refrigeration Plant (24). Emergency repair has been necessary on two occasions over the past few years after feeder sections faulted due to insulation failure. This failure rate is expected to increase as the insulation further deteriorates with age. Since the Building 3/13/14 complex houses the NASCOM, OPSCON, NCC, and other critical and sensitive functions, feeder failure during spaceflight missions cannot be tolerated, and cables must be replaced to preclude loss of data.

3. Repair Steam Line Between Buildings 6 and 11..... 390,000

This project provides for the replacement of approximately 1,000 linear feet (305 linear meters) of 4-inch (10 centimeter) diameter steam supply, 2 1/2-inch (6 centimeter) diameter condensate return, and associated high pressure drip lines from manhole 4 (near Building 6) through manholes 1, 2, and 3 to Building 11, Applied Sciences Laboratory. The existing lines are housed in a 14-inch (36 centimeter) steel conduit. The replacement lines will be preinsulated, direct burial, same size piping which will interconnect with the manholes., The existing underground steam and condensate system was installed in 1962, and numerous leaks have developed in the condensate line and the steel conduit due to severe corrosion. Presently, the condensate lines have been turned off resulting in high thermal energy losses. Repair of this line will reduce the high maintenance costs.

4. Repair Air Handling Units, Buildings 1, 4, and 23..... 400,000

This project provides for the replacement of 11 air handling units in Buildings 1 (Space Projects Building), 4 (Plant Operations Building), and 23 (Data Interpretation Laboratory), with necessary insulation,

piping, ductwork, electrical work, and controls. Three are in Building 1, one is in Building 4, and seven are in Building 23. The existing units have been in operation for 22 to 24 years. Due to deterioration and extensive operations, replacement is necessary at this time. This repair project will improve operating efficiency, reduce maintenance, and enhance the system reliability.

5. Replace Elevators, Buildings 5, 12, and 21..... 370,000

This project provides for the replacement of four elevators, one car each in the Instrument Construction and Installation Laboratory (5) and the Tracking and Telemetry Laboratory (12), and two cars in the Meteorological Systems Development Laboratory (21). This work includes the replacement of cabs, door, controls, related equipment, and all worn parts. Addition of provisions for the handicapped is also included. These elevators must be replaced at this time to assure adequate service in these buildings. These elevators have been in constant use since the early 1960's for transporting both personnel and freight. The elevators are frequently out of service and downtime is excessive (between 32 hours and 30 days in CY 1981) because of the difficulty in obtaining parts for the outdated elevators. Replacement of the elevators will restore dependable service and reduce repair and maintenance costs. Three of the elevators have 20-passenger, 4,000-pound (1,814 kilogram) capacity cars, and one has a 12-passenger, 2,500-pound (1,134 kilogram) capacity car.

D. Jet Propulsion Laboratory (JPL)..... 1,740,000

1. Repair Chillers, Various Buildings..... 400,000

These resources provide for the repair of ten large chillers serving Buildings 157, 168, 169, 179, 180, 198, and 238 at JPL. Work includes the repair or replacement of major components of these 100- to 300-ton capacity centrifugal chillers. Controls will also be replaced and connected to JPL's utility control system (UCS) to operate the chillers in a more energy efficient manner. These ten chillers are over 20 years old and are overdue for a major overhaul. The chillers operate continuously to provide cooling for computer support operations, electronic and optical research laboratories, and communications. The repair of these old chillers is necessary to improve reliability, reduce maintenance, and lower energy costs.

2. Repair Cooling Tower (166)..... 495,000

These resources provide for the repair by replacement of the closed section of Cooling Tower (166) at JPL. Work includes replacing the closed section of the cooling tower with a ceramic cooling tower of approximately 800 tons of cooling capacity. Work also includes the repair or replacement of the related mechanical and electrical equipment, an automated water treatment system, and suitable controls connected to the UCS. Cooling Tower (166) was built in 1956, has exceeded its useful life, and is in need of a major overhaul. The cooling

tower is a critical element for the continued operations of the 10-foot and 25-foot space simulators and the air-conditioning loads in Buildings 150 and 248. The repair of Cooling Tower (166) is necessary to continue to support space simulator test operations, and reduce maintenance and energy costs.

3. Repair Roads, Edwards Test Station (ETS) 420,000

This project provides for the repair of 116,000 square feet (10,776 square meters) of paved surfaces at the ETS of JPL. Work includes repaving of Process Road from Building E-40 to E-45, Road G from Building E-22 south to Circle Drive, and Circle Drive to Building E-55 with asphaltic pavement and a crushed rock base course. Also included is the aircraft taxiway approach and aircraft turnaround for large aircraft. These roads were constructed over 25 years ago, uneven settlement and the failure of the existing pavement have progressed beyond routine maintenance capability at this desert location. Further road failure is a safety concern for the transport of hazardous materials and fragile test equipment. Unless these roads are repaired, there is a probability they will become unusable and seriously impact the solid propellant research activities at this site.

4. Repair Exterior Surfaces, Various Buildings 425,000

These resources provide for the repair of the exterior surfaces of Buildings 144, 157, 198, 202, and 241 at JPL. Work includes the preparation and cleaning, grouting, caulking, and application of a waterproofing coating to the exterior surfaces of five buildings. Also included is the repair of the surface drainage of Buildings 157 and 198 to eliminate leakage into the buildings. These buildings were last painted over 12 years ago. The repair of the exterior surfaces of these five buildings must be accomplished at this time to prevent further deterioration and eliminate water leakage into the buildings.

E. Johnson Space Center (JSC) 1,440,000

1. Repair of Utility Generation and Distribution Systems (24) 250,000

This project is required to maintain the reliability, efficiency, and safety, on a planned cyclic basis, of the basic utilities that are generated and distributed from the Central Heating and Cooling Plant, Building 24. This is part of a multiyear repair program to preclude serious outages by scheduling work in relation to the service life expectancy of the various components. The work in this phase includes repair/replacement of 15 valves, 1 boiler, 1 pump, 1 chiller, 1 heat exchanger, 2 tower fans, sump pumps, various controls, expansion joints and piping insulation.

2. Repair of Roofs, Various Buildings 260,000

This project is part of a multiyear program to repair roofs of various buildings at JSC and is essential to the continued operation of JSC facilities. In this phase, work on Buildings 14, 15, and 356 will consist of removing and replacing damaged roof materials, including insulation board and flashing; and installation of moisture relief vents. A total of approximately 50,000 square feet (4,645 square meters) of roofing area on these three buildings will be repaired. Over the past 15 years, the normal aging process has resulted in numerous leaks and moisture accumulations in roofing materials. This project is needed to preclude damage to the building structure, as well as damage to interior ceiling panels, electrical panels, and sensitive equipment and electronics.

3. Repair of Heating, Ventilating, and Air-conditioning Systems, Various Buildings 475,000

This project is part of a multiyear program to repair heating and cooling equipment in various buildings at JSC. The work in this phase includes the repair or replacement of air handler casings and structures, compressors, condensers, controls, valves, pumps, condensate units, and fan/scroll assemblies. In addition, tasks of coil cleaning, damper and duct repair, suspension replacement, piping replacement or repair, instrumentation calibration, insulation, and painting of all components and ancillary equipment will be performed. This work will be completed in Buildings 7, 31, 35, 49, the Technical Support Facilities Area, and the Center Support Facilities Area. It includes the repair/replacement of 75 chilled water air handlers and ancillary equipment, replacement of 10 direct expansion air handlers and 2 condensate return units, repair of 3 blending stations and 3 steam stations, replacement of 5 control air compressors, and repair of 7 hot water converters. High humidity and salt/chemical content of the air in the region of JSC has caused serious deterioration in the aging coils, fans, and casings of air handling units. In addition, various heating and cooling system components are approaching the end of their useful life.

4. Repair of Roofs, NASA Industrial Plant, Downey, CA 455,000

This project is part of a multiyear program for the repair of roofs at the NASA Industrial Plant, Downey, California. This phase provides for the repair/replacement of approximately 165,000 square feet (15,328 square meters) of roofing on Building 001. Flashing, valleys, and gutters in these areas will also be replaced as required. The sawtooth portion of Building 001 was built in increments between 1928 and 1941. The roof has a history of numerous leaks and has required extensive repairs and patching over the years. Delay in reroofing could cause damage to the building structure, insulation, ceilings, walls and floors, as well as to costly hardware and test equipment.

F. Kennedy Space Center (KSC)..... 410,000

Partially Retube Central Heat Plant High Temperature Hot Water (HTHW) Generators..... 410,000

This project provides for the replacement of deteriorated boiler tubes in the firebox of the 17-year old HTHW Generators #1 and 82 at the KSC central heating plant. Gradual deterioration of the tubes was accelerated by a recent interim use of high sulfur fuel oil. The results have been excessive maintenance and difficulty in sustaining reliable operations. Failure to repair the damaged boiler tubes may result in the need for complete boiler replacement.

G. Langley Research Center (LaRC)..... 3,310,000

1. Repair of Roof (1268)..... 240,000

This project provides for the replacement of 19,000 square feet (1,765 square meters) of built-up roofing on Building 1268. New roofing material will be installed from the roof pan upward. The new materials will include insulation, flashing, and all other items necessary to restore the roof to its original condition. The condition of this 22-year old roof has led to frequent water leaks over equipment in the building. A roof survey has indicated that water becomes trapped between the layers and, on warm days, the roof blisters as the trapped water expands.

2. Repairs to High Pressure Air Systems.. 470,000

This project provides for repairs to five high pressure air distribution systems (6,000 psi, 5,000 psi, 1,800 psi, 600 psi, and 350 psi) which serve all research facilities in the west area of LaRC. The work includes replacement of all components subjected to pressures exceeding the compressors' pressure rating, radiographic inspection of welds in the older piping, and repair of all defective welds. This involves inspecting approximately 2,500 welds and repairing approximately 600 defective welds in the vicinity of Buildings 1247, 1264, 1265 and 1267. This repair work has been identified as part of LaRC's ongoing recertification program.

3. Repair to Switchgear, Taylor Road Substation..... 475,000

This project provides for the repair of the 6.6 kilovolt 'P' switchgear located in the Taylor Road Substation by replacement with new outdoor switchgear. The work includes installation of new switchgear, and reconnection of existing cables. Switchgear 'P' contains circuit breakers that are no longer manufactured. A failure in the switchgear could result in loss of service to the 4 X 7 Meter Tunnel, the Structures and

Materials Research Laboratory (Building 1148), the Fatigue and Fracture Research Laboratory (Building 1205), and the Frequency Converter Station (Building 1235).

4. Repairs to the Continuous Flow Hypersonic Tunnel (1251A)..... 465,000

This project provides for the fabrication of a new throat and replacement of the heater bundle for the Continuous Flow Hypersonic Tunnel. This facility produces environments that impose finite life cycles on test components due to cyclic temperatures and pressures. Due to these cyclic conditions, the throat and heater bundle have deteriorated and require replacement. This tunnel is a key heat transfer facility and also provides data on the interaction between reaction control jets and aerodynamic controls.

5. Repairs to Cooling Towers in Buildings 1241 and 583..... 350,000

This project provides for the replacement of a wood cooling tower located at Buildings 1241. The cooling tower for Building 1241 (2,800 gallons per minute (10,640 liters/minute)) serves the 16-Foot (4.8 meter) Transonic Tunnel. The repairs include new fill material, fans, mist eliminators, joists, decks, and water distribution systems. This cooling tower has deteriorated to a level that normal maintenance is ineffective and replacement is necessary.

6. Repair of Sanitary Sewers, West Area..... 395,000

This project provides for the replacement of existing sanitary sewer lines in the LaRC West Area. The existing lines have been in service for approximately 35 years. Due to earth settlement and root intrusion into the lines, significant cracking has occurred. This project includes the sliplining and repair of the cracked lines and joints as well as the removal of roots in the lines. The lines to be repaired include the following: (1) the sanitary sewer line from Lift Station No. 6 to Building 1230, (2) the line from Lindbergy Road to Walcott to the vicinity of Building 1229, (3) Building 1228 to the nearest manhole, and (4) Taylor Road to the west of Building 1218. In total, approximately 11,000 linear feet (3,350 meters) of line are included.

7. Repair of West Area Potable Water Piping..... 440,000

This project replaces 8-inch (20 centimeter) and 10-inch (25 centimeter) cast iron water mains in the LaRC West Area. Existing piping has been in service for approximately 30 years. The piping is extremely corroded. Potable water analyses indicate occasional levels of turbidity, color, manganese, and iron that are not in conformance with established standards. Included is the replacement of 6,000 linear feet (1,829 meters) of cast iron pipe with plastic pipe. These mains go west along Ames Road from Building 1222 to Building 1209:

west on Stratton Road and north on Warner Road to Ames Road; north between Buildings 1200 and 1208 from Ames Road to Bush Road; and on Stratton Road south to Building 1146.

8. Repair D2 Switchgear (640)..... 475,000

This project provides for the replacement of the existing D2 switchgear which supplies power to the 8-Foot (2.4 meter) Transonic Pressure Tunnel boundary layer compressor drives. The work requires removal of the existing switchgear, installation of new switchgear, and disconnecting and reconnecting cables to the existing loads. Manufacturer inventories are practically nonexistent for this equipment. Should a serious failure occur, it would require a long downtime before replacement parts could be manufactured.

H. Lewis Research Center (LeRC)..... 2,280,000

1. Repair Switchgear at Electrical Substation "C" (32)..... 440,000

This project will provide electrical repairs at Substation C, Building 32. The work includes replacement of seven medium voltage outdoor oil circuit breaker units with five dry type outdoor circuit breaker units and the addition of a 2,400 volt main circuit breaker at the C1 transformer. A circuit breaker will also be added to the C2 transformer. The existing oil circuit breakers are 40 years old and replacement parts are not available. These breakers also present a fire hazard and do not provide system protection equivalent to modern breakers. The modern oilless type circuit breakers will eliminate both the replacement parts problem and the serious fire hazard. The additional circuit breakers added to C1 and C2 transformers will provide switching capability for planned maintenance and assure continutity of power for research operations in the event that a problem and/or fault develops in the electrical equipment.

2. Repair of Steam Condensate System, Various Buildings..... 460,000

These resources provide for the repair of steam condensate piping, valves, traps, and condensate pumps in the Altitude Wind Tunnel, Building 7; the Icing Research Tunnel, Building 11; the 8-foot by 6-foot (2.4 meter by 1.8 meter) Supersonic Wind Tunnel (SWT) Drive Equipment, Building 53; the 8-foot by 6-foot (2.4 meter by 1.8 meter) SWT Office and Control, Building 54; the Structural Dynamics Laboratory, Building 56; and the 8-foot by 6-foot (2.4 meter by 1.8 meter) SWT Air Dryer, Building 57. These mechanical systems have been in service for over 25 years. Although the traps and strainers have been replaced as required over the years, the systems are now in need of complete replacement because of extensive corrosion and blockage.

3. Repairs to Rocket Engine Test Complex 310,000

These resources provide for the repairs to the Rocket Engine Test Complex located at the end of Lower South Road. Work includes repairs to the interior structural and mechanical/electrical equipment of the Rocket Engine Test Facility, Building 202, and the concrete apron adjacent to the building. All wall and ceiling areas of the building will be repaired. The existing unit heaters, piping, exhausters, lighting, and smoke detection systems in the building are old, inefficient and must be replaced. The concrete apron adjacent to the north side of the building is cracked and deteriorating in several places. A new concrete apron will be installed and surface and subsurface drainage will be provided. Maintenance of this 26 year old facility complex has become a continuing problem and these repairs are urgently needed to continue to provide rocket engine research and testing.

4. Repair Underpass Road from Brookpark Road to Walcott Road 310,000

This project provides for the repair and resurfacing of approximately 2,800 linear feet (853 meters) of Underpass Road between Brookpark Road and Walcott Road. The work includes replacing deteriorated portions of payment and resurfacing approximately 11,000 square yards (9,200 square meters) of pavement with a 2 1/2-inch (6.4 centimeter) layer of bituminous asphaltic concrete. Also included in this project is the surface repair of two bridges along Underpass Road. The bridge repairs consist of removing and replacing 280 square yards (234 square meters) of concrete median slab which has settled, and replacing 600 feet (183 meters) of concrete median curb. A new 1,400-linear foot (427 meter) sidewalk for safe pedestrian traffic will be provided along the west side of Underpass Road from Building 501 to the main gate, Building 108. A 440-linear foot (134 meter) safety barrier will be installed along the bridge area to protect pedestrians. Repair of the storm drainage system is also included in this project. Underpass Road is the main entrance roadway into the Lewis Research Center. The heavy traffic along this road along with the normal winter weather conditions of freezing and thawing have severly damaged this 20-year old road and major repair is necessary to prevent extensive pavement failure and to arrest the progressive deterioration of the subbase.

5. Repair of Electrical Power System at Substation K (89). 350,000

This project will provide for the repair of Substation K, Building 89, by replacing two 5,000/6,250 kVA, 6.9 kV - 2.4 kV transformers. Included in the project is all work associated with the disconnecting and removal of existing transformers, installation of new transformers, grounding, foundations, protective relays and controls. The two transformers, identified as K1 and K2, were installed as part of the 10-foot by 10-foot (3.1 meter by 3.1 meter) SWT Complex approximately 30 years ago. Now these transformers serve loads at seven additional buildings outside the 10-foot by 10-foot (3.1 meter by 3.1 meter) complex, and must be replaced.

Because K1 and K2 are electrically out of phase with other 2.4 kV sources at LeRC, parrallel operations are not possible. Therefore, this repair work will not only replace two aging transformers but will also permit parrallel operation with other transformers and thereby assist in handling the increased load.

6. Repair of Natural Gas Piping Distribution System 410,000

This project provides for the repair of the natural gas piping distribution system from Drop Tower, Building 45 to Combustion Research Laboratory, Building 35. The work includes replacement of approximately 3,000 feet (914 meters) of pipe ranging in diameter from 10 inches (25.4 centimeters) to 14 inches (35.6 centimeters). This piping is part of the primary gas distribution system which serves the main area of LeRC. Cathodic protection will be provided as part of the new pipe installation. This section of underground natural gas pipe is 35 years old, and the original installation did not include cathodic protection. As a result, the original coating is damaged and deteriorating causing increasingly frequent leaks. This project will reduce maintenance and hazards associated with gas leaks.

I. Marshall Space Flight Center (MSFC) 2,265,000

1. Repair/Replacement of High Pressure Gas System. 450,000

This project provides for a continuing program to replace unreliable sections of the high pressure gas pipelines which support vital MSFC laboratory and testing activities. Following the gaseous hydrogen (GH_2) explosion at Test Stand 500 and the fatal gaseous nitrogen (GN_2) asphyxiation accident at KSC, a plan was formulated to upgrade critical, high priority portions of the MSFC pipelines to current safety standards. These 25- to 30-year old systems are exceeding their design life and experiencing increasing failure rates. The work under this phase includes replacement of approximately 10,000 feet (3,048 meters) of GN_2 and gaseous helium piping to eliminate potential hazards due to corrosion and possible leakage. Priority will be given to piping under concrete slabs adjacent to inhabited buildings.

2. Repair Liquid Hydrogen (LH_2) Storage and Transfer Facility. 490,000

This project provides for the repair and refurbishment of the 110,000-gallon (416,350 liter), 75-psig LH_2 storage sphere at Building 4526/4527 which supplies LH_2 to Test Position 500, Building 4522. This liquid hydrogen storage tank was constructed in the mid-1960's and deactivated in 1967. Test programs scheduled for CY 1984 and beyond will require large quantities of LH_2 or liquified natural gas (LNG). At that time, continued use of trailer deliveries will be unsatisfactory for cost-effective test operation. This large storage facility must be completed and recertified for use of LH_2 or LNG to meet the OSHA and safety codes. The work includes

replacement of LH_2 system valves; cleaning of the sphere, loading and transfer piping system; and repair of the transfer system piping and controls, burnstack, and related utilities.

3. Repair Liquid Nitrogen/Gaseous Nitrogen (LN_2/GN_2) Facilities and High Purity Air system 450,000

This project provides for the repair and updating of the LN_2 storage and transfer subsystems, the LN_2/GN_2 conversion subsystems, and ancillary equipment to provide continued safe and efficient operations. These systems service the MSFC test stands, shops, laboratories, and support facilities. They are now at the end of their 20-year design life and have deteriorated through usage and age. Radiographic inspection of the systems has revealed deterioration in welds and the lack of cathodic protection has abetted corrosive leaks. These active systems are critical requirements in support of ongoing test programs including Space Shuttle work. The repair work includes inspection, repair, and cleaning of the storage vessels, interconnecting manifolds, transfer subsystems, high pressure pumps, and some 10,000 feet (3,048 meters) of distribution systems as necessary. Selected portions involving approximately 12,000 feet (3,658 meters) of the high purity air distribution system will be systematically cleaned to remove deposits accumulated during the past several years of operation.

4. Exterior Repairs, Various Buildings. 150,000

This project provides for painting of the exterior of Buildings 4548 and 4588. Work includes surface preparation and painting of approximately 170,000 square feet (15,793 square meters) of exterior surfaces. This painting is required to protect buildings against the cumulative damaging effects of deterioration and weather. Deferral of this project is not cost-effective because continuing deterioration/corrosion will require more extensive and expensive surface preparation requirements.

5. Repair Roofs, Various Buildings 400,000

This project is part of a continuing program to repair roofs at MSFC to rectify blistering, soft spots, drying-out and deteriorated insulation. These roof repairs are essential to protect and preserve facility capability and to remove the threat of unscheduled interruption to MSFC operations. The normal roof lifetime experienced at MSFC is 15 years and, in many cases, this has been exceeded. The most severely deteriorated roof areas of Buildings 4347, 4475, 4628, 4610, 4667, 4705, 4732, 4733, 4764, and 4775 are scheduled for repair. Under this project, approximately 106,000 square feet (9,847 square meters) of roofing will be repaired which includes replacing roofing, insulation, damaged flashing, and resaturating roof surfaces to a firm smooth finish.

6. Repair Heating, Ventilating, and Air-conditioning (HVAC) Components (4201)..... 325,000

This project provides for replacement of components in the chilled water air-conditioning system serving Building 4201 which is a major element of the MSFC Headquarters complex. It is essential that it be maintained in an efficient and cost-effective manner. Constructed in 1964, the HVAC system is now obsolete, inefficient, and requires continuous maintenance and repair. This project will reduce maintenance costs, support MSFC's energy conservation efforts, and keep the facility in a good state of repair. The work included in this project involves removal of the existing chillers and installation of two 195-ton chillers, air compressors for HVAC pneumatic controls, chilled water pumps, condenser water pumps, chilled water coils, mixing boxes, and steam coils.

J. Michoud Assembly Facility (~F)..... 1,765,000

1. Repair MAF ~arf..... 495,000

This project provides for the replacement of the 130-foot (39.6 meter) long wharf located adjacent to the MAF east barge dock. This wharf at one time was 260 feet (79.2 meters) long. Half of the wharf sank when deteriorated structure gave way and has since been removed from the water. The remaining portion of the wharf, which is required for mooring of the barges during loading of external tanks for shipment to the launch sites, is unusable because of its deteriorated state, and must be restored.

2. Repair Underground Cooling Water Lines..... 240,000

This project provides for replacing the existing underground cooling water lines from cooling tower 127 to Buildings 110, 130, and 103 with above ground distribution system. These lines serve the chillers located in Building 110, the trichlorethylene still in the thermal protection system (TPS) mix room in Building 130, and various equipment in Building 103. Recent repairs have revealed the badly deteriorated conditions of the underground piping which could cause a disruption in the external tank production should a failure occur. To correct this situation, approximately 500 linear feet (152.4 meters) of piping, ranging from 6 to 18 inches (15.2 to 45.7 centimeters), will be installed.

3. Repair Chemical Waste Lines (103)..... 265,000

This project provides for lining approximately 2,000 linear feet (609.6 meters) of chemical waste drain lines under the floor slab of Building 103. Deterioration of joint compounds along with ground and floor settlement have been the major factors causing leaks and cracks to the existing drain lines. To correct this problem, a 1/4-inch (.6 centimeter) chemical resistant liner will be installed without breaking through the

concrete floor to repair the damaged vitrified clay pipe. The existing lines vary from 6 inches to 12 inches (15.2 centimeters to 30.5 centimeters) in diameter and drain the Chemical Cleaning and Plating Facility and the Major Component Cleaning Area.

4. Repair Electrical Feeders #1 and #5 300,000

This project provides for the replacement of approximately 4,000 feet (1,219.2 meters) of underground electrical feeder cable. Feeder #1 supplies electrical service to the computer areas, offices, and cafeteria in Building 103, and Feeder #5 supplies electrical service to three substations in the main manufacturing production area for external tanks. The existing 13,800 volt feeders are approximately 40 years old, deteriorating, and have exceeded their expected useful life. The new feeders will be ethylene propylene rubber insulated cables, shielded with a polyvinyl chloride jacket.

5. Repair Cell E Deoxidizer Lining 465,000

Cell E in the Vertical Assembly Building is used for cleaning and drying of the ET LO_2 and LH_2 tanks. This project provides for the repair/replacement of the special protective coating applied to Cell E in 1978. This protective coating, which has an approximate life of only 5 years, protects the concrete wall of Cell E from the acid soultion used in cleaning the LO_2 and LH_2 tanks. If the coating is not replaced, rapid deterioration of the underlying cell surface will occur. The work includes removal of coating. from those areas that are peeling, blistering, or flaking; neutralizing the acid effect on exposed concrete; smoothing and fairing such areas and then applying new lining material.

K. National Space Technology Laboratory (NSTL) 1,525,000

1. Repair of High Pressure Gas (HPG) Distribution System Components 450,000

This project provides for continuation of a multiyear plan to repair the HPG system components within the Space Shuttle Main Engine (SSME) complex, cross-country HPG systems, and base facilities. Many components in the HPG system are 12 to 15 years old and have been subjected to severe use and stress, including submersion, electrolytic corrosion, and periodic removal and chemical cleaning during system maintenance. Many of the components are obsolete and spare parts cannot be bought and must be custom-made. With the extremely high operating pressures, in addition to normal wear and tear, their continued deterioration constitutes a safety hazard to both personnel and equipment. The work will include the following: component disassembly, cleaning and repair; reassembly and installation; and system certification on completion of installation activities. The components to be repaired include 30 pressure regulators, 30 relief valves, 20 manual valves, and other related components.

2. Repair of High Pressure Gas Compressors and Pumps. 250,000

This project provides for the overhaul of the high pressure gas transfer pumps and compressors used in the generation of high pressure gas in support of SSME operations. The work includes overhaul of 7 liquid nitrogen pumps, 2 air compressors, 3 helium compressors, 6 intercooler shell jackets on helium compressors, and replacement of 2 intercooler water pumps. The compressors will be subject to major overhaul including replacement of valve assemblies, pistons, plungers, sleeves, bearings, and crank shaft. This equipment has been in constant use at the equipment design capacity. To preclude major failures, which would seriously impact the SSME testing schedule, it is necessary to overhaul this equipment at this time in accordance with the equipment manufacturers' recommended maintenance and service schedule.

3. Repair High Pressure Industrial Water Valves..... 450,000

This project provides for the inspection and repair of all major valves in the high pressure industrial water (HPIW) system which furnishes water to the test complexes to cool the engine test stand flame deflectors and for water deluge fire protection on test stands. The system also furnishes water for fire protection of the propellant barges. Work includes inspection and repair of four 30-inch (76.2 centimeter) gate valves, two 36-inch (91.4 centimeter) ball valves, eight 12-inch (30.5 centimeter) flex-flow valves, and 42 smaller valves. Maintenance has been of a preventive nature and only critical repair and replacement of parts have been accomplished due to the demanding firing schedule. The valves have reached their expected service life of 20 years and must be repaired in order to continue the uninterrupted service. A failure in the HPIW could result in the destruction of the test stand flame deflectors or a major catastrophe in the event of a fire on the stand or propellant barges.

4. Repair Roofs, Various Buildings 375,000

This project provides for the repair of the roofs of nine permanent buildings. These roofs are 15 to 18 years old. Expansion and contraction of these roofs over the years and the prolonged high temperatures and rainfall have caused cracks and separations where scuttles penetrate the roofs and where roofs adjoin parapets. Moisture has seeped into the underroof membranes causing accelerated deterioration. Work includes the repair and/or replacement of selected sections of deteriorated roof on one building totaling 3,000 square feet (279 square meters) and complete replacement of roofs on eight buildings having 95,700 square feet (8,890 square meters) of 5-ply built-up roofing.

L. Wallops Flight Facility (WFF) 230,000

Repair of Various Roofs..... 230,000

This project provides for the repair of 58,000 square feet (5,388 square meters) of roofing on Buildings F-1, F-2, Y-15, W-65, Y-60, D-8, C-15, and X-55 at the Wallops facility. The work will include replacement of wet or damaged insulation, coping, flashing, gravel stops, and other related roof accessories. These are the original roofs on buildings which were constructed more than 20 years ago. The roofs have lasted longer than their designed life expectancy and now contain numerous patches and temporary repairs. To assure that personnel and equipment inside are protected, replacement is now required to preserve the integrity of the structures.

M. Various Locations..... 680,000

1. Repair of Exterior Surfaces, Various Antennas, Goldstone, California..... 480,000

This project provides for the repair of the exterior surfaces of the 34-meter DSS-12 antenna, the 26-meter DSS-13 antenna, and the 64-meter DSS-14 antenna to restore radio frequency performance and protect the antennas from further deterioration. Oil, dirt, and deteriorated coatings will be removed and the surfaces will be treated with a highly reflective protective coating applied to all structural members, A highly infrared refractive protective coating will be applied to all radio frequency path members. This work will restore the original temperature deflection control of the various antenna members to provide the original level of radio frequency performance.

2. Repair of Roads, Goldstone, California..... 200,000

This project provides for the repair and seal coating of approximately 6 miles (10 kilometers) of paved surfaces at the Goldstone Deep Space Network complex. The work includes repair of shoulders, drainage, and pavement replacement and sealing. In addition to normal wear, flash floods and the extreme temperature variations'of the desert environment adversely affect the roads at this complex. This project will repair the most deteriorated paved surfaces at the Goldstone complex.

MISCELLANEOUS PROJECTS LESS THAN $150,000 EACH...	345,000
TOTAL.....	19,500,000

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

An estimated $20,000,000 per year will be required for the continuation of this essential repair program.

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OF

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1984 ESTIMATES

SUMMARY

REHABILITATION AND MODIFICATION

Summary of Project Amounts by Location:	Amount	Page No.
Ames Research Center	2.205. 000	CF 10-3
Dryden Flight Research Facility	845. 000	CF 10-4
Goddard Space Flight Center	2.135. 000	CF 10-5
Jet Propulsion Laboratory	1.980. 000	CF 10-7
Johnson Space Center	2.200. 000	CF 10-9
Kennedy Space Center	1.455. 000	CF 10-11
Langley Research Center	2.495. 000	CF 10-12
Lewis Research Center	3.145. 000	CF 10-14
Marshall Space Flight Center	2.445. 000	CF 10-17
Michoud Assembly Facility	925. 000	CF 10-19
National Space Technology Laboratories	1.375. 000	CF 10-20
Wallops Flight Facility	1.535. 000	CF 10-21
various Locations	1,310. 000	CF 10-23
Miscellaneous Projects Not Exceeding $150. 000 Each	450. 000	CF 10-24
Total	24.500. 000	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1984 ESTIMATES

PROJECT TITLE:	Rehabilitation and Modification of Facilities, Not In Excess Of $500,000 Per Project		
INSTALLATION:	Various Locations		
		FY 1984 CoF ESTIMATE:	$24,500,000
FY 1982:	$17,700,000	FY 1983:	$19,000,000

COGNIZANT INSTALLATIONS/LOCATION OF PROJECT: Various Locations

COGNIZANT HEADQUARTERS OFFICE: Office of Management

SUMMARY PURPOSE AND SCOPE:

These resources will provide for the rehabilitation and modification of facilities at NASA field installations and Government-owned industrial plants supporting NASA activities. Included in this request are those facility rehabilitation and modification needs for FY 1984 that have been fully identified at the time of the submission of these estimates, and that are estimated not to exceed $500,000 per project. The purpose of this program is to restore or enhance the condition of a facility so that it can more effectively accomplish its designated purpose or, increase its functional capability.

PROJECT JUSTIFICATION:

Based on the initial investment costs, the NASA capital type property totals approximately $7.7 billion (September 30, 1982), of which the physical plant comprises some $3.2 billion. A continuing program of rehabilitation and modification of these facilities is required to:

a. Protect the capital investment in these facilities by minimizing the cumulative effects of wear and deterioration.

b. Ensure that these facilities are continuously available and that they operate at peak efficiency.

c. Improve the capabilities and usefulness of these facilities and thereby mitigate the effects of obsolescence.

d. Provide a better and safer environment for all personnel.

e. Provide significant reductions in energy consumption through the initiation of energy conservation projects including improved utility control systems.

This program includes only facility rehabilitation and modification work having an estimated cost not in excess of $500,000. The work is of such a nature and magnitude that it cannot be accomplished by routine day-to-day facility maintenance or by related routine facility work efforts that are provided for in other than CoF estimates. Rehabilitation and modification work estimated to cost more than $500,000 is reflected as a separate major CoF line item project.

PROJECT DESCRIPTION:

Proposed rehabilitation and modification projects for FY 1984 totaling $24,500,000 are described under "PROJECT COST ESTIMATE." Only those projects estimated to cost less than $150,000 have not been individually described or identified by Center. The total cost for these miscellaneous projects is $750,000. The total program of $24,500,000 has been distilled from requests of approximately $32,300,000 and represents only a modest request in relation to the backlog of this type of work. Based on relative urgency and expected return on investment, the projects which comprise this request are the highest priority requirements. Deferral of this mission-essential work would adversely impact the availability of critical facilities, program schedules, and energy conservation objectives.

During the course of the year, some rearrangement of priorities may be necessary. This may force a change in some of the items to be accomplished. Any such change will be accomplished within available resources. The following broad categories of work are described further in the "PROJECT COST ESTIMATE:"

a. Utility Systems	5,360,000
b. Fire Detection/Protection Systems.	2,805,000

c. General Purpose Buildings 4,890,000

d. Technical Buildings/Structures 10,835,000

e. Building Exteriors and Roofs 610,000

PROJECT COST ESTIMATE:

A. Ames Research Center (ARC) 2,205,000

1. Rehabilitation and Modification of Animal Research Laboratories 460,000

Planned biomedical research for Spacelab programs requires animals with a known record of care, health, and genetic purity. Reasonable laboratory standards have been set by the American Association for Accreditation for Laboratory Animal Care; the existing laboratory does not meet these standards. This project upgrades the animal laboratory to these standards to provide continued support to biomedical space experiments. This project will replace the metal corrugated roofing on the existing laboratory with a built-up roof; lighting and plumbing fixtures will be rehabilitated; ventilation and air-conditioning will be modified to meet the special needs of animal facilities; and partitions for proper hygiene and laboratory conditions will be installed.

2. Rehabilitation and Modification of 7-Foot by 10-Foot Wind Tunnel (N-215) 460,000

The air exchange system in the 7-Foot x 10-Foot (2.1 meter x 3 meter) Wind Tunnel No. 1 (Building N-215) provides make-up and exhaust of circulating air, controlled by the setting of adjustable vanes. For laser velocimeter flow measurements, the vanes are closed so as to isolate tunnel air from the atmosphere. During other operations the tunnel temperature is regulated by the air exchange system by means of the adjustable vanes. Investigations have determined that the configuration of the hinge pivots and vane structure trap rain water, which in turn has rusted the mechanisms to the point that the vanes are inoperable. It is now necessary to shut down the tunnel and weld in, or remove, sheet metal baffles in order to accommodate varying test requirements. The conversion requires about 40 man hours of labor. This project will restore the proper operation of the air exchange system, provide accurate remote actuation of the vanes, and modify the adjacent structure to avoid water retention and structural deterioration.

3. Modification of 60 Megawatt Interaction Heating Facility 485,000

This test facility is used to test heat shield systems and materials to 3,000°F (1,650°C) at Mach numbers up to 7.5. Its flexibility and range of operation are limited because of its fixed nozzle geometry

and the inability to reposition the arc heater to accommodate different length nozzles. To provide the test environment necessary for current and future heat shield research objectives, nozzles of different shapes, diameters, and lengths will be built to increase the energy density of test gases. A moveable arc heater support stand positioning track will be provided. This proposed modification will provide a greater test matrix of test temperatures and model sizes, and will extend the existing temperature limits of the facility.

4. Rehabilitation and Modification of Flight Experiments Facility (N-240)..... 350,000

This project provides 3,200 square feet (297 square meters) of laboratory and shop areas in Building N-240 for animal holding rooms, an electronic lab, bonded stores, and a material control station (storage and issue of equipment and supplies). ARC is responsible for developing, testing, and verifying Spacelab experiments involving plants and animals. These materiel activities are now being conducted in a remotely located office trailer which also houses contract employees, thus incurring risk of damage or contamination of hardware and test materials during transport between sites. This project will provide a single integrated area to support all phases of experiment development for the Life Sciences Spacelab.

5. Rehabilitation and Modification of Electrical Services Building..... 450,000

This project provides for the rehabilitation and modification of the Electrical Services Building which was built 42 years ago and has never been renovated. Major work is required to upgrade the office portion of the building and convert shop and chemical lab areas to open office space. The work will include rehabilitation of air-conditioning and electric power distribution systems; partitioning for offices, conference rooms, and computer areas; and ceiling and lighting modifications. This rehabilitation will provide approximately 8,500 square feet (790 square meters) of usable office space to allow consolidation into one area of the U.S. Army Research Technology Laboratories Headquarters, now located in three dispersed buildings. Three areas vacated by the Army will be occupied by ARC's Facility Services Division personnel (Building N-207), 12-Foot Wind Tunnel test personnel (Building N-206), and NASA/university cooperative programs (Building N-218).

B. Dryden Flight Research Facility (DFRF)..... 845,000

1. Modification to Electric Power, Mission Control Complex..... 360,000

Commercial power at DFRF is unreliable, with poor voltage regulation and frequent (average 13 per year) power outages. Transient voltage spikes of 200 volts are common. The Aeronautical Test Range (ATR) mission requires reliable power within a close voltage and frequency range for collection, processing, and distribution of experimental aircraft flight data. This project will provide an off-the-shelf 250 kVA uninterruptible power source (UPS) unit. Incoming commercial power will flow through the UPS, which will remove voltage and frequency

fluctuations. In event of a power outage, the UPS will provide power from its battery system to the ATR computer system for up to 1 hour. Reliable power of high quality is necessary for consistency of research data, monitoring flight safety parameters, and Shuttle landing support.

2. Modification of HVAC System (4800)..... 485,000

Over a period of years, there have been numerous modifications and additions to the main building at DFRF. The air-conditioning and heating ducts, fed from several fan houses on the roof of this large building, have been routed to accommodate each individual project. The total result has been a system which cannot be properly balanced and is marginal for proper air flow and heat removal from computer areas. This project will modify portions of the building-wide air distribution duct system to meet computer requirements and minimum personnel comfort standards, and realign the system to allow proper balancing.

C. Goddard Space Flight Center (GSFC)..... 2,135,000

1. Modifications for Gamma Ray Observatory (GRO) Data Capture Facility (23)..... 320,000

This project will provide for modifications to 2,250 square feet (209 square meters) of space in Building 23 to accommodate automated data processing (ADP) equipment for the GRO project. The work will include partition removal or relocation; electrical, HVAC, and fire sprinkler system modifications; addition of computer flooring, and minor architectural and structural changes. This project is necessary to permit the installation of the GRO ADP equipment when it is delivered in November 1984, and permit timely activation and software preparation to support a 1987 launch date.

2. Modifications of Bridge Cranes (lo)..... 490,000

This project will provide for the modifications of the bridge crane systems in Building 10. Two new bridge cranes, each with a lifting capacity of 7-1/2 tons (6,804 kilograms), will replace existing cranes with capacities of only two tons (1,814 kilograms). This increase in capacity is necessary for the heavier loads encountered when moving flight hardware and components from the first floor of the Environmental Testing Laboratory, Building 10, to the subbasement. In addition, the 15-ton (13,608 kilogram) crane in Building 10 will be modified to provide a multiple speed controller. The minimum speed of the existing controller is too fast for large spacecraft and experiment handling in and around the Space Environment Simulator and the Shuttle Bay work stand.

3. Modifications to Instrument System Integration Facility (20)..... 480,000

This project will provide for the modifications to 6,600 square feet (613 square meters) of Building 20, including the 3,500-square foot (325 square meter) Instrument Systems Analysis Verification Facility. The modifications will entail removal and relocation of existing partitions, and installation of new partitions to accommodate expansion of existing laboratory space. A new entrance on the south side of the building will be installed. The work will also include modifications to the mechanical and electrical systems, addition of computer floors, fire protection systems, a personnel access control system, zoned roomlighting, and a darkroom. In addition, a high-bay white room with an airlock/change and a I-ton (907 kilogram), 45-foot (14 meter) bridge crane will be provided. The Instrument Systems Analysis Verification Facility provides for integration of large scale science and applications instruments for simulation, validation, and calibration. The facility will provide support for such programs as Cosmic Background Explorer (COBE), and Space Optical Telescope (SOT) simulation. This modification will provide a completely integrated instrument clean room and simulation facility with its associated data acquisition, processing, and control computers, and the technical staff that will be used for many projects. This facility, when dedicated to instrument integration and simulation, can shorten lead time in personnel training and instrument development between projects by not requiring reconstruction for each separate mission.

4. Modifications to Clean Rooms, Payload Testing Facility (7)..... 480,000

This project provides for the rehabilitation of four class 10,000 clean rooms in the Payload Testing Facility. The work includes the installation of automatically sequenced control stations for the 11 fans (490 HP total) on the main control board in Building 7 and provision of remote control by interfacing with the utility control system in Building 24. Also included is the replacement of high efficiency particulate air (HEPA) filters in these clean rooms. Total replacement involves 796 filters that are 2 feet by 2 feet by 1-foot (61 centimeters by 61 centimeters by 30 centimeter) and 53 filters that are 2 feet by I-foot by 1-foot (61 centimeters by 30 centimeter by 30 centimeter). The automatically sequenced control stations allow operations to start and stop fans in a manner consistent with the cleanliness requirements of these rooms while saving approximately 641,000 kWh and 2,000 man-hours per year. Currently, these clean rooms are marginal in complying with the Federal standards for a class 10,000 cleanliness level. To maintain the current level, fans are run 100 percent of the time (168 hours/week). By installing new HEPA filters, the air flow will be greatly increased allowing one 40 HP and two 50 HP fans to be turned off during periods of low activity. Programs requiring use of these facilities are Cosmic Background Explorer (COBE), Space Telescope (ST) instruments, Gamma Ray Observatory Instruments, and Shuttle instruments.

5. Modifications to Install Crane in Radio Frequency Interference (RFI) Room (7) 365,000

This project provides for the installation of a 5-ton (4,535 kilogram) capacity variable speed bridge crane in the existing 35-foot by 59-foot by 20-foot (11 meter by 18 meter by 6 meter) high RFI clean room of the Payload Testing Facility, Building 7. The use of flight experiments has created increased difficulties in handling the experiments, associated fixtures, and equipment within the RFI room and creates a greater probability of accidental damage. The current procedures for handling material within the room require 7 to 12 people to position a sizeable object such as the first Shuttle payload. The proposed crane will considerably reduce the handling manpower requirement while improving safety in handling. This added capability will allow the integration and test of flight hardware in the same room, which presently must be integrated elsewhere and then moved into this RFI room. This project will support the integration of Gamma Ray Observatory Instruments (EGRET), Cosmic Background Explorer (COBE), Space Telescope Instruments (ST), and other Shuttle instruments.

D. Jet Propulsion Laboratory (JPL) 1,980,000

1. Modification of Electronics Laboratory (189) 355,000

These resources provide for the modification of 3,200 square feet (297 square meters) of space in the Electronics Laboratory (189) for advanced semiconductor research. This work includes the modification of 1,360 square feet (126 square meters) of laboratory space for a clean room facility. It also includes insulation, air-conditioning, fire protection, lighting, and related mechanical and electrical work. The modification of the Electronics Laboratory (189) is required to relieve crowded conditions and to provide laboratory space for additional equipment for advanced semiconductor research activities. Planned future programs in the facility, as now configured, are limited by the availability of laboratory space and inadequate environmental conditions.

2. Modification of Fabrication Shop (103) 230,000

These resources provide for the modification of 1,500 square feet (139 square meters) of shop space in the Fabrication Shop (103) for a clean room facility. Work includes partitions, flooring, ceiling, lighting, insulation; a 10-ton air-conditioning system, fire protection, and related mechanical and electrical installations. This modification of the Fabrication Shop (103) is required to provide a clean, controlled environment for the development of etched flexible cables for use on spacecraft and instruments.

3, Modifications of Heating, Ventilating, and Air-conditioning (HVAC) System, Systems Division Office (126)..... 355,000

These resources provide for the modifications of the HVAC in the Systems Division Office (126) at JPL. Work includes the modification of the air supply systems and replacement of one chiller unit. The controls will be replaced and connected to the JPL utility control system (UCS). The HVAC system in the Systems Division Office (126) is over 20 years old and the temperature control and air distribution are inadequate to provide cooling for the computers and electronic equipment now installed in the building. These modifications to the HVAC system are necessary for the development of mission operations computer systems, to reduce maintenance, and to lower energy costs.

4. Modification of Central Engineering Building (180)..... 405,000

This project provides for the modification of 93,000 square feet (8,640 square meters) of space in the Central Engineering Building (180) at JPL to improve life safety conditions. Work includes the installation of a wet pipe sprinkler system, fire alarms, and smoke detectors to attain an adequate level of fire protection. Also included is the extension of the fire service main to Building 180 and the connection of the building fire detection system to the main alarm console in Building 281. This project is a major element in the fire prevention and suppression program for the protection of personnel and high value research equipment at JPL. Building 180 is a nine-story steel-framed office building with 250 occupants and a replacement cost of over $15 million. The glass-lined corridor exit system in this building could present serious exiting hazards if a fire occurred. The installation of an automatic fire sprinkler system is the most cost effective method of providing minimum fire safety.

5. Modification of Materials Research Laboratory (158)..... 235,000

These resources provide for the modification of laboratory space in the Materials Research Laboratory (158) for the development of custom hybrid microcircuits. This work includes the modification of 1,000 square feet (92 square meters) to provide a clean room environment. Included are modifications to the lighting, air-conditioning, and mechanical and electrical systems. These modifications are necessary to provide controlled space for the expanded laboratory operations in the development, fabrication, and testing of flight hybrid microcircuits.

6. Modification of 2.4 kV Electrical System... 400,000

These resources provide for the modification of the 2.4 kV primary electrical power distribution supply for 17 buildings and conversion to the 16.5 kV primary system. Work includes the replacement of Transformer

Bank Numbers 19 and 25 and associated cables with a new bank near Building 80. Also included is the related site work and electrical distribution equipment. The 2.4 kV electrical power system is over 30 years old, deteriorated, and inadequate to supply the building power requirements. The modification of the 2.4 kV electrical system is urgently needed to provide a reliable system for the continuous operation of these buildings.

E. Johnson Space Center (JSC)..... 2,200,000

1. Modification of the Central Computing Facility (12)..... 150,000

This project provides for the relocation of the JSC central word processing computer system, including mass storage, communications, input/output, and tape equipment. This computer system has been temporarily located in Building 32A to accommodate higher priority activities in Building 12. The ongoing replacement of the Univac 1100 series computers in Building 12 with smaller but higher capacity equipment will free sufficient space to permit return of the central word processing system to Building 12. In addition, surplus IBM 4341 equipment has been acquired which will allow this system to take advantage of more economical and newer data communications systems and thereby increase computing capabilities. This project includes redistribution of air-conditioning; disconnection, relocation, and reinstallation of existing computer units; construction of fire wall, fire detection and suppression system, and other safety auxiliaries; and removal of deactivated power cables and installation of data bus cables to various buildings.

2. Modification to Various Facilities for Safety Compliance.. 250,000

This project provides for the modification of various facilities at JSC to comply with Occupational Safety and Health Administration (OSHA) standards. This work will eliminate major deficiencies that are itemized in an OSHA compliance survey and include closing in open staircases with fire walls and fire doors for fire protection and additional emergency exits. This project will also provide sound control shelters in shop and industrial facilities where excessive equipment noise is experienced and charcoal filters in clean room air-conditioning systems to filter out air-borne flourocarbons released by cleaning agents.

3. Modification of Electrical Power System (7)..... 495,000

This project provides for the installation of one 1,500 kVA transformer, one 85 kVA emergency power generator, and 3.5 kVA of uninterruptible battery power in Building 7. It also includes replacing, combining, and redistributing the existing feeder circuits to various laboratories in the building and relocating existing batteries for uninterruptible power from inside the building to the equipment room on the east side of the building. These modifications are necessary to provide for long duration space missions being planned for the

early 1990's which will require regenerative environmental control system (ECS) testing in the mid-1980's. Many of these missions are high power consuming and long time duration activities that will increase the Building 7 average load to 1,400 kVA. Without the Building 7 power increase, there will be severe limitations to both Shuttle extravehicular maneuvering unit crew training and advanced ECS tests. Also, the potential will exist for damaging electrical systems by operating them continually at or near full load conditions. This project will also enhance the safety of the building by relocating large quantities of batteries from inside Building 7 to the equipment room on the east side of the building.

4. Modifications to Domestic Water System 225,000

This project is the final phase of a 2-year program for modifications to portions of the JSC water system. The work in this phase includes replacement of approximately 30 shutoff valves, 10 fire hydrants, installation of 8 water meters and a chlorinator for the domestic water system. Two meters are required to monitor the water distribution either from Clear Lake City to JSC, or vice versa, to establish regular city water billings. Four meters are required to monitor performance of the central cooling system by measuring water consumption in the cooling tower cells at Building 24. The remaining two meters monitor water distribution from the ground water storage tank to major portions of the site. This project will provide a more reliable supply of water for JSC and improve performance monitoring of the central cooling system.

5. Modification of Site 1 Facilities, Air Force Plant 42, Palmdale, California..... 305,000

This project provides for the modification and rehabilitation of various buildings and systems that are a part of NASA's final assembly and checkout facilities for the Orbiter located at Site 1, Air Force Plant 42, Palmdale, California. The work in this project is required to support increased manufacturing activity in the facility and includes the rehabilitation of a freight elevator; installation of a water filtration system to prevent contamination of domestic and industrial water systems; installation of a water treatment system and blowdown capability for boilers in Building 294 to prevent mineral buildup in the steam boiler equipment; extension of the existing emergency power service to Building 294 cooling tower fan and pump motors to provide more reliability; construction of a paint facility to provide a weather protected environment for painting large assemblies, tooling, material handling equipment, etc.; rehabilitation of two boilers in Building 294 to replace damaged and deteriorated firebrick linings and boiler tubes; and rehabilitation of bridge cranes in Building 294 to comply with OSHA regulations.

6. Rehabilitation of Flight Operations Support Facilities, Ellington Air Force Base..... 475,000

This project provides for rehabilitation of NASA's aircraft operations support facilities at Ellington Air Force Base and consists of rehabilitation of aircraft mooring aprons and aircraft engine test facilities

originally constructed 1942. The aircraft mooring aprons have cracked and settled in many places due to failure of the base material. Spalling of the apron concrete where cracks have occurred and movement of aircraft across these areas are factors which result in excessive wear and costly maintenance on the aircraft. Rehabilitation of aircraft engine test facilities is required because the control facilities are old and have deteriorated with continuous usage in a humid and salt/chemical atmosphere. The project includes replacing approximately 2,000 square yards (1,672 square meters) of concrete slabs including base material and joint sealant, and sealing 1,000 linear feet (305 meters) of concrete slab cracks. The rehabilitation of aircraft engine test facilities consists of providing approximately 3,000 linear feet (914 meters) of electrical powerline, waterline, and underground telephone cable; flood lighting; emergency shower; and control cable in overhead conduit from the aircraft engine test stand to control room to fuel boost pumps, and the instrumentation building. These test facilities support NASA's Shuttle Transportation System training and the in-house T-38 engine rebuild program which saves NASA approximately $1,000,000 yearly.

7. Modifications of Altitude Simulation System, Test Stand 401, White Sands Test Facility.. 300,000

This project will provide for modifications to the Altitude Simulation System at Test Stand 401 to improve the efficiency of the existing steam ejector system. The modifications will save propellants, permit greatly improved test schedule responsiveness, increase reliability, and provide more flexible test capability for continuing Shuttle reaction control system engine testing, Shuttle enhancement, and technology development programs. The work consists of removing the existing 9-foot (2.74 meter) ejector system and the converging and throat sections and replacing them with 5-1/2 foot (1.68 meter) diameter sections and smaller steam nozzles. This modification will allow for a reduction of two steam generator modules from the present three-module operation, effecting a minimum savings of 130,000 pounds per hour (58,983 kilograms/hour) of steam generation.

F. Kennedy Space Center (KSC)..... 1,455,000

1. Modification to Launch Complex 39 Pad A for OTV Lighting System..... 410,000

This project replaces portable Xenon lights with stadium type area lighting consisting of five pole-mounted light banks located around the Pad apron. The existing Operational Television (OTV) lighting systen is extremely old, costly to maintain and operate, and exceeds current lighting requirements. New low light sensitive OTV cameras requiring 80 percent less light have been installed on the pad. The lights installed with these resources will be identical with sodium vapor area lighting used elsewhere at Pad A, thus reducing repair parts and bulb stock requirements. Payback on the upgraded system is 2 years.

2. Modifications to Launch Complex 39 Pads A and B Lighting for Energy Conservation..... 435,000

This project provides replacement of 300-watt incandescent lamps having an average life expectancy of 750 hours with 70-watt high pressure sodium lamps having an average life of 22,000 hours. The current incandescent lamps require changeout approximately three times a year and requires disassembly of the fixtures for bulb replacement. Annual savings, comprised of both energy and labor elements, approximate $202,000 for a simple payback of 2.7 years. Switch gear will be included to isolate indoor/outdoor circuits.

3. Rehabilitation and Modification of Launch Complex 39 Pad A Perimeter Fence..... 260,000

This project replaces approximately 210,000 feet (64,008 meters) of the Launch Complex (LC-39) Pad A perimeter fence which has deteriorated due to age and the launch environment (acidic deposition) to a point beyond maintenance and repair. The 7-foot (2.1 meter) high fence will be replaced-in-kind with double-dipped galvanized 8-foot (2.4 meter) fencing fabric, and posts topped with ribbon-wire concertina. Work is required to maintain security provisions to protect the STS vehicle and launch facilities. A subsequent project to install a second perimeter fence with man-trapped gates and anti-personnel remote sensors will be needed to satisfy National Resource Protection (NRP) requirements.

4. Rehabilitation of Central Supply Warehouse Roof..... 350,000

This project provides rehabilitation of approximately 74,000 square feet (6,875 square meters) of metal roof on the Central Supply Building by use of a plywood and shingle overlayment. A recent inspection to determine why numerous leaks exist in spite of repeated maintenance revealed the roofing metal to be insufficiently rigid, thus loosening fastening devices as the metal flexed due to weather variations. Modifications and repair of all applicable appurtenances will be made as required.

G. Langley Research Center (LaRC)..... 2,495,000

1. Modifications to 0.3 Meter Transonic Cryogenic Tunnel (1242)..... 475,000

This project provides for the replacement of the existing diffuser section and nitrogen injection section of the 0.3 Meter Transonic Cryogenic Tunnel. The existing diffuser does not have sufficient flow quality to support developmental work in minimizing wall interference and the airfoil research program. The modifications to the nitrogen injection section will reduce boundary layer separation in the diffuser. As a result of these modifications, the tunnel will be extended approximately 12 feet (4 meters), which requires the relocation of the drive system. Flow quality measurements in the facility have indicated that the short

transition-diffuser section of the tunnel is the major source of flow unsteadiness which causes flow separation in this section.

2. Rehabilitation of Circuit Breakers, Stratton Road Substation..... 330,000

This project provides for the rehabilitation of circuit breakers at the Stratton Road Substation. Existing circuit breakers numbers 1020 and 1025 have an interrupting capacity rating of only 3,500 megavolt amperes (MVA). Present available fault levels are approaching and may exceed this level due to new facilities being brought on line. This project will provide for the installation of circuit breakers rated at 10,000 MVA to assure long term reliability. A failure in either circuit breaker could result in extensive damage to the entire substation area and a possible total loss of power to LaRC.

3. Rehabilitation of Electronic Materials Laboratory (1283)..... 485,000

This project provides for the rehabilitation of approximately 11,000 square feet (1,020 square meters) of shop and laboratory space within the Electronic Materials Laboratory. The work includes repairs to the roof, exterior walls, windows and doors, improvement of the heating, ventilating, and air-conditioning systems, lighting, and power system. In addition, rotting wood walls and a ceiling presently enclosing 900 square feet (840 square meters) of laboratory area will be demolished and will be replaced with masonry walls and a built-up roof to provide approximately 1,600 square feet (149 square meters) of additional space. This work is necessary due to the deterioration of the facility since its original occupancy in 1958. This rehabilitation will reduce maintenance, increase efficiency, and increase space utilization for the Physical and Optical Electronics Research Laboratories.

4. Modifications to Steam Supply System (1267)..... 380,000

This project will provide an increase in the steam capacity to the steam ejectors in Building 1267. The increased steam capacity will enable all of the steam ejectors to be operated to extend the continuous operation envelope of the arc-heated facilities to cover desired thermal protection research. This is to be accomplished by increasing the steam supply piping from a 4-inch (10 centimeter) to an 8-inch (20 centimeter) line and providing a new pressure reducing valve. The steam line to be replaced extends from Building 1247 to Building 1267.

5. Modifications for a Wide Angle Visual Environment Simulator (1220)..... 390,000

This project will provide for an environmentally-controlled enclosure totaling approximately 2,000 square feet (185 square meters) in Building 1220 for a computer-generated image subsystem and a wide angle

multiviewer display subsystem. Also included are modifications to the mechanical, electrical, and heating, ventilating, and air-conditioning systems. These modifications are necessary to support studies of terminal area and ground handling characteristics of aircraft in the landing environment. The Wide Angle Visual Environment Simulator facility will provide visual simulation that will allow full-crew involvement in the study of advanced technologies for future aircraft.

6. Rehabilitation of Vertical Spin Tunnel (645)..... 435,000

This project provides for the rehabilitation of the Vertical Spin Tunnel to improve its productivity, efficiency, and safety of operation. This work includes cleaning and treating of the external steel structure, replacement of the roof, and cleaning, repairing, and coating ofthe internal structural members. An additional entrance will be installed at the ground level. A four-story elevator will be installed in the existing shaft in Building 645A. New screens will be installed and the flow control honeycombs will be rehabilitated to improve the lateral and vertical velocity gradients in the test section. This tunnel is the only operational spin tunnel in the United States. This work is necessary to support critical research regarding spinning and spin recovery for aircraft. This facility, built in 1941, is in need of upgrading to insure its continued operation.

H. Lewis Research Center (LeRC)... 3,145,000

1. Modifications for Fire Protection Systems, Various Buildings 200,000

These resources provide for modificatons to three buildings for installation of smoke detection systems. The systems will be installed in the Administration Building 3, Development Engineering Building 500, and the Development Engineering Building Annex, Building 501. The work includes installation of detector heads, associated control, transmitter and display panels, and emergency power backup together with necessary conduit and wire. Alarm signals will be connected to the central station protective signaling system to alert the LeRC fire station. The installation of smoke detection systems in these buildings will provide early warning of fires in the incipient stages thereby enhancing life safety and reducing fire and smoke damage.

2. Modification of Mechanical Systems, Research Analysis Center (142)..... 420,000

This project provides for the modification of the mechanical systems in the Research Analysis Center, Building 142. The work will increase the mechanical cooling system from 300 tons to 500 tons. The existing piping system will be modified to increase its capacity from 350 gallons per minute (1,324 liters per minute) to 800 gallons per minute (3,028 liters per minute) in the Operations Room 160. The mechanical systems in the Research Analysis Center presently has the capacity to provide 200 tons of cooling for the computer equipment

area and 100 tons of cooling for the office area. With the addition of the Class VI computer system in FY 1982, the present capacity of the cooling system will be fully utilized. LeRC's projected requirement for additional computers and other equipment, through 1988, indicated additional cooling will be needed. This project for additional mechanical cooling will allow fuller utilization of the building space.

3. Modification of Vacuum Tank 5 in the Electric Propulsion Laboratory (301) 480,000

This project provides for the modification of Vacuum Tank 5 in the Electric Propulsion Laboratory, Building 301. The vacuum pumping capacity will be increased to accommodate the testing of advanced gas thrusters by the installating a freon-shielded, liquid nitrogen, helium-cooled cryopumping system with necessary support equipment. A new heat exchanger and a diffuser duct will also be provided to absorb/dissipate thruster exhaust. Future Shuttle missions will involve space systems of large size and low total weight. These structures cannot withstand rapid accelerations when operating as free bodies in earth orbit, and advanced gas thrusters must be developed. In order to have such thrusters available to meet the needs of future Shuttle payloads, these facility modifications must start in FY 1984. These thrusters use inert gas propellants such as argon, xenon, hydrogen, or ammonia which have high vapor pressures, and are much harder to evacuate than other gases. Therefore, a helium-cooled cryopanel and diffuser duct pumping system will be added to the existing pumping system to handle the increased pumping load.

4. Rehabilitation and Modification of Main Cafeteria Kitchen (15) 460,000

This project provides for the modification of approximately 4,800 square feet (446 square meters) of space in the main cafeteria kitchen in the Utilities Building 15. The work includes demolition and removal of existing wall partitions and mechanical systems, and the installation of new walls, ceilings, floor covering, coolers/freezers, cooking equipment, and associated mechanical/electrical services. The main cafeteria is the major food preparation and food storage area for the three cafeterias at LeRC. The kitchen equipment is old and severely limits efficient preparation of food. The modifications proposed will provide for improved food storage, preparation, and cooking facilities.

5. Modification of Electrical System at Substation B (13) 320,000

This project provides for modifications to the 34.5 kV electrical distribution system at substation B, Building 13, to increase reliability. The work includes the rearrangement of electrical service lines, transformers, and circuit breakers. Additional metering and instrumentation for power dispatch information will also be provided. The electrical modifications provided by this project will ensure continuous cooling water supply to various research facilities during interruptions of electrical service. This project also provides for isolation of subsystems within the substation, thereby eliminating a potential hazard to maintenance

personnel. The metering modifications will provide for improved power dispatch information necessary to effectively manage electrical power into and through this substation.

6. Rehabilitation of Filtering System of Cooling Tower No. 1 (10)..... 340,000

This project rehabilitates the filtering system at Cooling Tower No. 1, Building No. 10. The work includes the installation of new collectors for the settling basins, a chemical feed system to improve the removal of oil and solids, new floating oil skimmers, holding tanks for collecting oils, and a new sludge pump with associated piping. There has been a significant increase in the number of research facilities served by Cooling Tower No. 1 since its construction in 1944. In addition, much of the research equipment of today requires more stringent cooling water quality control. The existing basins are hydraulically overloaded and are inefficient in the removal of solids and oil from the cooling water. These solids and oil tend to form a sludge that blocks small cooling passages and builds up on heat exchanger surfaces. This problem shortens research time and demands frequent cleaning of equipment. The new equipment will increase solids and oil removal efficiency, improve research run times, and minimize cooling equipment maintenance and cleaning.

7. Rehabilitation of Exterior of 10-Foot by 10-Foot Supersonic Wind Tunnel Office (86)..... 445,000

This project provides for the exterior rehabilitation of the 10-Foot by 10-Foot (3.1 meter by 3.1 meter) Supersonic Wind Tunnel Office Building 86 by modifying the fenestration to improve thermal efficiency. The work includes the replacement of existing single glazed windows and metal frames with insulated windows and panel assemblies that will reduce the window area by 58 percent. This will result in an approximate savings of 20 percent in heating and air-conditioning costs. Interior patching around windows is also included. The windows are 27 years old and have severely deteriorated allowing excessive air infiltration, and snow and water leakage, causing discomfort and inconvenience to the building occupants and critical heat loss.

8. Rehabilitation and Modification for Material Testing (34)..... 480,000

This project provides for the rehabilitation and modification of approximately 10,000 square feet (9,300 square meters) of interior space in the Equipment Utilization Building 34. This facility will contain test cells, laboratories, control rooms, and support services areas and will be used for testing materials in turbine engines. The work includes new masonry, interior walls, doors, ceilings, flooring, painting, closure of window areas with masonry and rehabilitation and modification of utilities. This project will accommodate the replacement of the test cells located in the north section of the Special Projects Laboratory (24). After relocation of the test cells, the north section of Building 24 will be demolished. The present configuration of environmental test cells in Building 24 is crowded and unacceptable. One rig cannot be modified or adjusted while other rigs are in operation. This means that long-term testing in some rigs precludes efficient use of

the short cycle runs and any modification or repair work shuts down the runs of all other rigs in the cell. Placing the test rigs in individual cells in the modified facility of Building 34 overcomes this problem and improves efficiency, productivity and safety, and eliminates the degradation of research data due to cross contamination between rigs.

I. Marshall Space Flight Center (MSFC)..... 2,445,000

1. Rehabilitation and Modification of Sound, Power, and Area Warning Systems in East Test Area..... 465,000

This project will refurbish and modify the area warning test control systems in the East Test Area to establish a centrally located, computerized control system. The project will also replace existing signal light systems with remotely operated swing-arm type road barriers for positive control of access to individual test positions. The current sight/sound warning system is approximately 20 years old and must be operated from two manned control stations in order to apply warning systems for hazardous tests. These resources will eliminate the manned control stations and allow each test position to activate the appropriate warning and access control devices through use of a central computer.

2. Rehabilitation and Modification of Developmental Processes Laboratory (4711)..... 155,000

This project provides for the rehabilitation and modification of a portion of Building 4711. This building is the primary technical facility used by MSFC for research and development of materials. It houses sophisticated testing and research equipment that directly supports all major programs, such as the Space Shuttle Main Engine, space flight experiments, and other MSFC activities. The facility was constructed during the early 1940's and is heavily used. It has now reached the point where normal maintenance cannot keep it in an acceptable state of repair. This work is needed to better support ongoing programs and advance the state-of-the-art in materials and process development. The work will consist of rehabilitating approximately 3,000 square feet (279 square meters) of office space and adjacent halls, removing an overhead air handler, and installing a new unit in an existing equipment room. It also provides for replacing heating, ventilating, and air-conditioning (HVAC) system servicing the clean room area, enclosing the north loading dock, and replacing chillers located in Building 4714 which service Building 4711.

3. Rehabilitation and Modification of Heating, Ventilating, and Air-conditioning Systems and Interior Offices (4200)..... 450,000

This project provides for rehabilitation and modification of the HVAC systems in Building 4200, MSFC's central administration building. This work is necessary to reduce maintenance costs and support MSFC's energy

conservation goals. This building was completed in 1963 and major rehabilitation work has not been accomplished during the past 20 years of very heavy usage. This project provides for HVAC system modifications which consist of air volume reduction by fan drive changes, outside air damper adjustments, modifications to system controls and ducts, and replacement of high velocity mixing boxes. Also included in this project is the rehabilitation of approximately 150,000 square feet (13,935 square meters) of Building 4200 interior. The work provides for floor covering replacement in high traffic areas, refinishing walls in high visibility and usage areas, replacing damaged ceiling tiles, necessary renovation of the elevators, repairing and replacing restroom fixtures, and upgrading lighting fixtures and electrical systems.

4. Rehabilitate Storage and Office Building (4471)..... 450,000

This project will provide for the rehabilitation of 80,000 square feet (7,432 square meters) of storage and office space in Building 4471. This facility, which was constructed in 1943, is a single-story multiuse building supporting various centralized MSFC functions, including shipping and receiving, storage and issuance, graphics, the central electronic calibration laboratory, and other office areas. Energy conservation will be achieved through improving the HVAC and lighting systems, and insulating open truss areas in the warehouse as well as in office ceilings. Other work includes the resurfacing of floors, addition of new partitions, renovation of toilet areas, interior painting, modifications to vestibules, and replacing ceiling tiles.

5. Rehabilitate Shop Building (4705)..... 450,000

This project provides for rehabilitation of mechanical, electrical, and architectural systems in Building 4705, with the major emphasis on mechanical systems. Building 4705 is NASA's largest and most sophisticated machine shop facility providing a unique fabrication and test capability which has supported and will continue to support all major test and development programs, such as Shuttle, Spacelab, and space processing. This building has seen heavy use since it's construction in the late 1950's and has now reached the point where routine maintenance is insufficient. The work in this phase will include: (1) relocation of hot water converter and steam pressure reducing station from North High Bay to Equipment Room E101; (2) removing existing air-cooled split system and installing new chilled water air handler, controls, economizer cycle, and ducting serving Room B104; (3) installing floor-mounted air handling unit heaters to replace overhead heaters in South High Bay, installing steam-to-hot-water converter, pump and piping system for heat distribution; and (4) modifying chilled water distribution system so that the entire building can be served from chiller system in the southeast corner, and removing the 260-ton chiller in the auxiliary building.

6. Modifications to Provide Automation of Building Systems Management.. 475,000

This project will increase the use and efficiency of the existing computer-based utility control system (UCS) through the addition of energy conservation options such as outside air temperature cutout and reset, true economizer cycle, supply air reset, optimized chiller control, and damper closure. These options will be implemented through existing software and addition of new hardware into the existing UCS energy management systems for seven buildings (4207, 4487, 4570, 4619, 4705, 4708, and 4712). The system was designed to accept additional energy-saving options and additional buildings. These further additions will expand the UCS to achieve additional fossil fuel savings and reduction in systems operational costs. This investment will be recovered in 2 years.

J. Michoud Assembly Facility (MAF)..... 925,000

1. Rehabilitate Heating and Cooling Coils, Cells B and C (110)..... 440,000

This project provides for replacing the heating and cooling coils of Cells B and C in Building 110, where foam insulation is applied to the LH_2 tank. The existing heating and cooling coils, which are 20 years old, are deteriorating and require considerable corrective maintenance. The present locations of these coils are inaccessible for maintenance. This project will provide new duct work, new coils, steam and chilled lines, and replace associated valves, traps, piping, and controls. This project is critical to the production of external tanks in support of the Space Shuttle Program.

2. Rehabilitate Fire Alarm System. 485,000

This project provides a new fire alarm system to replace the unreliable components of the existing system; the automatic heat and smoke detectors, sprinkler water flow detectors, and manual pull stations at MAF. Records indicate that 10 percent of the system was inoperable for more than 3 months and another 10 percent has been inoperable for more than 6 months. Replacement parts are difficult to obtain because the manufacturer has discontinued making the components/parts. Signal problems cannot be transmitted during power interruptions because the system uses the building's electrical power and there is no back-up power supply. Also, during wet weather the system encounters water-caused electrical failures. To correct this situation, a new alarm system with a new control processor unit located in the central fire station will be installed with its own dedicated power supply to monitor approximately 250 detectors.

K. National Space Technology Laboratory (NSTL)..... 1,375,000

1. Rehabilitation of Fire Alarm System.. 450,000

This project provides for the rehabilitation and modification of the fire alarm system at NSTL. The current system is 20 years old and is unreliable. During the past year, a number of relays have failed and replacements are unobtainable because they are no longer being manufactured. Parts have been cannibalized to retain the operational capability of the system in high priority facilities. Deterioration of the cable has resulted from water exposure at the cable splices in the underground duct system. In addition, there are ten remote buildings without any fire alarm system. Also, the current system requires the responding fire fighters to check an annunicator panel to determine the location of the alarm. To correct these deficiencies, new relay panels will be installed and tied into the utility control system (UCS). Also, additional UCS memory capability for programming the fire alarm system will be provided. Approximately 40 heat/smoke sensors and pull stations will be added along with minor partition rearrangement to the Fire and Security Dispatch Office.

2. Modifications to Oral Warning and Paging Systems.. 275,000

This project provides for the replacement of cables for the oral warning and paging systems. This is the final phase of a multiyear project. This system was installed in 1965 and the cables have now deteriorated to such an extent that, when a fault occurs, it is extremely difficult to find a spare circuit to replace the damaged cable. Failure to implement this project may result in interruption of the oral warning and paging system during periods of hazardous testing or emergency weather conditions. This system is used for primary notification to the working population on NSTL. The paging system is also used for crowd control during periods of natural disaster when disaster victims are sheltered at NSTL. Work consists of installing new cables in existing ducts, and installing above-ground pedestal terminations for all cable splices. The project provides for the installation of approximately 55,000 feet (16,764 meters) of cable between the central control facility and the maintenance/supply/security area and the river complex.

3. Modifications to the Utility Control System (UCS)..... 175,000

This project provides for expansion of the UCS to conserve additional energy (electricity and natural gas) and enable better utilization of maintenance personnel through expanded use of UCS software capability. Work includes the installation of approximately 50 temperature, humidity, flow and pressure sensors, and associated conduit and cabling. Conduit and cabling will also be installed to approximately 75 sensors and control devices such as watt hour/demand meters, relays, and switches for monitoring energy consumption and providing status (on-off) and control (start-stop) of systems and equipment. It is estimated that the payback for this project will be approximately 5 years.

4. Rehabilitation to Warehouse (2204)..... 175,000

This project provides for enclosing the 5,000-square foot (465 square meter) loading dock. Roll-up doors and heating and water sprinkling systems are also included. A large volume of critical spare parts and components for the Shuttle Support Program (including expensive cryogenic and high pressure gas components, pipe, and cable) are currently being stored in outside areas, due to the lack of enclosed storage space. This situation has led to rapid corrosive deterioration of these components. Also the inner surface of the concrete block walls will be patched and sealed with a water seal primer. This inner area, which is approximately 22,000 square feet (2,044 square meters), is environmentally-controlled for the storage of electronic parts and paper goods. Sealing of the bare concrete block walls will retard heat and moisture penetration and save energy. To reduce moisture infiltration when the doors are open, plastic curtain strips at the door openings will be provided.

5. Rehabilitation and Modification to Building 1105..... 300,000

This project provides for essential safety modifications to Building 1105 which will also improve operating conditions and reduce building energy consumption. The functional use of this facility has changed from an electronics, instrumentation and materials laboratory to a wet chemistry and biological analysis laboratory which now requires 100 percent outside air and maintenance of appropriate air pressures to minimize potentially hazardous cross-ventilation between chemical laboratories. These features and. other safety modifications are essential to minimize the exposure of personnel to detrimental effluant particulates and to protect the facility structure and systems from a hazardous environment posed by the chemical processes. The work includes modifications to the heating, ventilating, and air-conditioning system, emergency lighting, fire detection, and alarm system, sprinkler system, and electrical power distribution system to ensure compliance with material regulatory codes.

L. Wallops Flight Facility (WFF)..... 1,535,000

1. Rehabilitation of Telemetry Receiving and Recording Facility, Building N-162..... 425,000

This project will provide for the rehabilitation and modification of the Telemetry Receiving and Recording Facility, Building N-162. The exterior work will include the installation of a waterproof insulated panel system to preclude water infiltration and damage, and to reduce energy consumption; replacement of windows and doors with energy efficient units; and the construction of a personnel vestibule at the main entrance to eliminate flooding during driving rains. Interior work will include the replacement of light fixtures and the rehabilitation of the HVAC and electrical systems. This 24-year old facility houses range operations in support of sounding rocket launches at WFF. The building is in poor condition, but continued usage is essential to

the sounding rocket program. This rehabilitation is necessary to maintain the integrity of the building, to improve the comfort of personnel, and to reduce the consumption of energy.

2. Modifications to Install an Energy Monitoring System 350,000

This project provides for installation of an energy monitoring system for the WFF utility systems. The system will monitor facility energy use, building environmental conditions, major HVAC equipment performance, and the WFF's energy distribution systems (electrical, central chilled and hot water, steam and condensate return). The central monitoring system will consist of meters, sensors, receiving and recording units, and data storage and retrieval equipment. WFF has achieved a 28 percent reduction in utility energy use and sdditional energy reduction requires an effective energy monitoring system to ensure that the energy resources are used at optimum efficiency. This system will keep continuous records of energy usage at the major facilities. It will also provide a spot check on energy consumption patterns, and will aid in scheduling heavy users to keep demand charges low.

3. Rehabilitation and Modification of Rocket Storage Buildings 485,000

This project provides for modification to Rocket Storage Buildings M-15, 16, and 20 and the adjacent heating plant buildings M-17, 19, and 21. The rehabilitation of these buildings, containing 38,000 square feet (3,530 square meters) will include roof repair and replacement, repair of flashings and downspouts; repair of separations in block walls; replacement of deteriorating metal personnel doors; and waterproofing and painting of exterior walls. Also included is an addition on the west side of Building M-16 for the storage of flight hardware. This addition will be masonry construction and include HVAC, power, lighting, and sprinkler systems. The buildings are over 25 years old, and are in a very deteriorated condition, due mainly to persisting water leakage through the walls and roofs. Since the facilities are used to store large rocket motors, igniters, and pyrotechnics, and also to provide radiographic inspection, the rehabilitation work is essential at this time. The additional space is urgently needed to store the additional flight hardware, presently stored at GSFC's Greenbelt location.

4. Rehabilitation of Dynamic Balance Facilities, Buildings V-45, V-50, and V-55..... 275,000

This project provides for the general rehabilitation of the Dynamic Balance Facilities located on Wallops Island. The rehabilitation work includes the replacement of roofs, installation of an insulating wall system on the exterior walls of Building V-50, rehabilitation of existing exterior metal panel systems on Buildings V-45 and V-55, sandblasting and painting of all metal surfaces (including the covered walkway), replacement of lighting fixtures, and rehabilitation of the HVAC and electrical systems. Building V-50 is the Balance Monitor Control Facility which provides remote control of the equipment in the two Spin Balance Buildings

(V-45 and V-55). The buildings are connected by a 300-foot (91 meter) long covered walkway. These facilities are a critical element in the WFF pre-flight testing program. The buildings have deteriorated to a point that failure to rehabilitate will compromise the capability and structural integrity of the facilities.

M. Various Locations 1,310,000

1. Rehabilitation and Modification for Fire Protection - Goldstone Complex.. 200,000

This project rehabilitates the deteriorated, obsolete fire detection systems at the DSS-12, DSS-13, and DSS-14 antenna sites at the Goldstone Deep Space Network (DSN) complex. It also includes modifications for necessary fire detection and suppression systems in various areas that are unprotected. This work must be accomplished to adequately protect these remote sites for maintaining critical spacecraft tracking support.

2. Modification of DSS-43 64-Meter Antenna Reflector, Canberra, Australia..... 310,000

This project modifies the 64-meter antenna at DSS-43 in Australia to improve the radio frequency performance. The work includes structural and mechanical improvements to correct for antenna gravity deflections and misalignments of the 64-meter primary reflector, the subreflector, and the electronics feed cone. The performance improvement at lower elevation angles will be especially significant in compensating for the greater atmospheric loss effects at antenna pointing angles near the horizon. As a result, data losses that occur during the daily transfer of spacecraft tracking support between the Canberra Complex and the other DSN Complex's (Goldstone, California and Madrid, Spain) will be reduced. This work will enhance the support of the Voyager-Uranus encounter from the Australia DSN complex.

3. Modification of DSS-63 64-Meter Antenna Reflector, Madrid, Spain 310,000

This project modifies the DSS-63 64-meter antenna in Spain to improve the radio frequency performance. The work includes structural and mechanical modifications to correct for gravity deflections and misalignments of the 64-meter primary reflector, the subreflector, and the electronics feed cone. The performance improvement at lower elevation angles will be especially significant in compensating for the greater atmospheric loss effects at antenna pointing angles near the horizon. As a result, data losses that occur during the daily transfer of spacecraft tracking support to and from the Madrid, Spain, Complex will be reduced. This work will enhance the support of the Voyager-Uranus encounter from the Madrid DSN complex.

4. Modifications for Utility Control System, Canberra, Australia..... 490,000

This project will provide a microprocessor based utility control system (UCS) for the main DSN complex in Australia. The UCS will provide real-time monitoring and/or control of the engine generators; heating, ventilating, and air-conditioning systems; lighting; fire protection and security systems; power and water distribution systems; and tracking equipment. Weather data and tracking schedules will be input to the UCS to enable predictive responses. This project will reduce operating costs and energy consumption through improved control of the facilities systems and equipment, and reduce the number of personnel required. Programmatic support of spacecraft missions will also be improved through increased reliability and monitoring.

MISCELLANEOUS PROJECTS LESS THAN $150,000 EACH..... 450,000

TOTAL..... 24,500,000

FUTURE COF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

An estimated $25,000,000 per year will be required for continuing rehabilitation and modification needs.

MINOR CONSTRUCTION OF FACILITIES

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1984 ESTIMATES

SUMMARY

MINOR CONSTRUCTION

Summary of Project Amounts by Location:	Amount	Page No.
Ames Research Center	460,000	CF 11-2
Dryden Flight Research Facility	230,000	CF 11-3
Goddard Space Flight Center	680,000	CF 11-3
Jet Propulsion Laboratory	865,000	CF 11-4
Kennedy Space Center	475,000	CF 11-5
Langley Research Center	760,000	CF 11-6
Lewis Research Center	440,000	CF 11-7
Marshall Space Flight Center	200,000	CF 11-8
National Space Technology Laboratories	490,000	CF 11-9
Various Locations	200,000	CF 11-9
Total	4,800,000	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1984 ESTIMATES

PROJECT TITLE:	Minor Construction of New Facilities and Additions to Facilities, Not In Excess Of $250,000 Per Project
INSTALLATION:	Various Locations
	FY 1984 CoF ESTIMATE: $4,800,000
FY 1982: $2,300,000	FY 1983: $3,750,000

COGNIZANT INSTALLATIONS/LOCATION OF PROJECT: Various Locations

COGNIZANT HEADQUARTERS OFFICE: Office of Management

SUMMARY PURPOSE AND SCOPE:

These resources will provide for minor facility construction at NASA field installations and Government-owned industrial plants supporting NASA activities. Each project included in this program is estimated to cost not more than $250,000 and involves either the construction of new facilities or additions to facilities. The FY 1984 request of $4,800,000 will improve the usefulness of NASA's physical plant by changing the utilization of or augmenting the capabilities of various facilities. Included in this request are those programmatic and institutional projects that are essential to the accomplishment of mission objectives.

PROJECT JUSTIFICATION:

The configuration of NASA's physical plant necessarily must respond to changes in utilization and adaptations required by changes in technology or in mission needs. Demands are generated by research, development, test, and similar activities. Specific justification for each minor construction project is provided under "PROJECT COST ESTIMATE."

PROJECT DESCRIPTION:

Included in the FY 1984 minor construction program are those facility projects for institutional or technical facility needs which could be fully identified at the time of submission of this budget estimate. Items of work totalling $4,800,000 are included in this resource request and have been distilled from a list totalling over $6,600,000. Projects were selected on the basis of the relative urgency of each item and the expected return on the investment. During the course of the year, rearrangement of priorities may require changes in some of the items to be accomplished. Such changes will be accommodated within the resources allocated.

These projects represent requirements that must be met in this time frame to support institutional needs and programmatic objectives. The following listing summarizes the cost distribution by category of work:

a. Utility Systems	615,000
b. General Purpose Buildings	1,620,000
c. Technical Buildings/Structures	2,330,000
d. Pavements and Drainage	235,000

PROJECT COST ESTIMATE:

A. Ames Research Center (ARC)	460,000
1. Addition to Flight Data Acquisition Facility	230,000

This project will provide a 1,950-square foot (180 square meter) building adjacent to Building N-256 for computer operations, system programming, and data handling and processing in support of research flight operations. The flight data acquisition function is being moved from trailers and other scattered facilities to Wlilding N-256. This facility is necessary to efficiently consolidate the whole operation in one central area with adequate space, a reasonable noise environment, and visibility of aircraft operations to support an increased rate of helicopter and short-haul research flight test operations.

2. Construction of Maintenance Support Shop	230,000

Space is required at ARC for the Center maintenance contractor's storage and supply of plumbing, painting, carpentry, electrical, and heating, ventilating, and air-conditioning equipment, and shop space for

repairs. Currently being used is a 38-year old temporary metal building of inadequate size and poor condition which is scheduled for demolition. A 4,700-square foot (435 square meter) building with drive-in capability will be built on the site of a building which is to be razed.

B. Dryden Flight Research Facility (DFRF)..... 230,000

Addition to Aircraft Maintenance Dock..... 230,000

The existing Aircraft Maintenance Dock consists of hangar and shop facilities with very limited office space. The dock, which now supports the Air Force F-16 test program, requires additional office space for assigned test, contractor support, and Air Force personnel. Valuable shop space has been temporarily converted to administrative space; seven leased trailers are also in use. This 2,200-square foot (210 square meter) building addition will provide administrative, conference, technical library, and utility space; and will allow elimination of leased trailers and proper use of critically needed shop space.

C. Goddard Space Flight Center (GSFC)..... 680,000

1. Construct Additional Two Lanes of Road No. 4 Between Road No.'s 3 and 7.. 235,000

This project will provide for widening Road No. 4 from two to four lanes between Road No.'s 3 and 7. Included in the project are 1,260 linear feet (384 meters) of 22-foot (6.7 meter) wide asphalt pavement with a 2-inch (5 centimeter) wearing surface, a 4-inch (10 centimeter) binder course, a 5-inch (13 centimeter) gravel base course on compacted fill, and associated curbing. In addition, the project provides for relocation of storm inlets and street lights, utility manhole modifications, and revision of the Building 98 septic system. Road No. 4 is a four lane major east/west artery at GSFC, connecting GSFC with the Baltimore-Washington Parkway entrance, except at the approaches to the intersection with Road No. 3 where the four lanes reduce to two lanes. The location of this constriction is a safety hazard. Many accidents have occurred and the road must be widened to improve safety and traffic flow.

2. Construction of Loading Dock and Freight Elevator, Building 28, Technical Processing Facility..... 230,000

This project provides for the construction of a two story, 1,200-square foot (111 square meter) addition to the two floors of the northwest corner of the Technical Processing Facility, Building 28. The work will include the installation of a 6,000-pound (2,730 kilogram) capacity hydraulic freight elevator; and the construction of an equipment room, loading dock, asphalt access drive to Road No. 1, and a turnaround for the delivery trucks. The mechanical services for the structural steel addition will be extended from the existing

building ana the exterior brick finish will match the existing building. At present, all supplies of computer paper and tape must be received on the east side of Building 28 and moved the entire length of the building before reaching the principal computer area. Due to the size of pallets used for delivery of supplies and equipment, and the restricted corridor space, it is necessary to break the shipments down into smaller units. Installation of a freight elevator and loading dock near the computer area will eliminate these inefficient supply delivery problems.

3. Construction of Loading Dock Addition to Building 305, Spacecraft Magnetic Test Facility 215,000

This project provides for the construction of an addition to the Spacecraft Magnetic Test Facility to increase the size of the existing loading dock from 600 square feet (183 square meters) to 1,390 square feet (424 square meters). The addition will serve as a vestibule between the controlled laboratory environment and outside weatner. The loading dock vestibule will include a 5-ton, 20-foot (9.6 meter) hook height crane for handling payloads. The personnel vestibule will provide an area for visitors and employees to change from street clothing to laboratory clothing before entering the controlled area. In addition, improvements to the air handling system will provide better environmental control. The construction materials shall be nonmagnetic so as not to interfere with the experiments. The existing loading dock is too small to safely handle the larger size Shuttle era payloads.

D. Jet Propulsion Laboratory (JPL)..... 865,000

1. Construction of Addition to Weigh and Control Building, Edwards Test Station (ETS) (E-35) 235,000

These resources provide for the construction of a 420-square foot (39 square meter) addition to the east end of the Weigh and Control Building E-35, ETS. The addition will be of reinforced concrete block walls, concrete slab and apron, wood roof framing, and built up roofing. Work also includes expanding the control room, a communications trench, lighting, and replacing the mechanical equipment. The addition provides space for new equipment for the remote control of hazardous propellant mixers for the preparation of solid rocket motors. Improved systems control capability is necessary for increased reliability required for the advanced propellant development programs.

2. Construction of Addition to Robotics Research Laboratory (278) 235,000

These resources provide for the construction of a 1,520-square foot (141 square meter) addition to the south side of the Robotics Research Laboratory 278 at JPL. The addition will be of reinforced concrete block

walls, concrete floor slab, and wood roof framing to match the existing building. Interior work includes a restroom facility, computer flooring, partitions, ceiling, lighting, fire protection and heating, ventilating, and air-conditioning systems. This addition is required to provide space for laboratory, electronic fabrication, and software analysis work related to subsystems for highly automated spacecraft. Present facilities are inadequate to support the increased research activities in automating spacecraft for future programs.

3. Construction of Addition to Plant Engineering Building (200) 170,000

These resources provide for the construction of a 2,300-square foot (214 square meter) addition on the east side of the Plant Engineering Building (200) at JPL. The addition will be of steel framing on a concrete slab, metal siding and roof deck. Work also includes partitions, lighting, fire protection, and mechanical and electrical power systems. This addition is required to provide weather protection and secure storage of emergency maintenance supplies and tools. Insufficient enclosed storage for maintenance supplies has resulted in extra transportation time and manpower, and physical damage to materials being stored in remote buildings and weather-exposed locations.

4. Construction of Entrances to Various Buildings 225,000

These resources provide for the construction of entrances to seven buildings at JPL. Work includes the construction of ten concrete or steel stairways on Buildings 111, 126, 130, 144, 156, 157, and 161. A three-story enclosure over the west stairway of Building 126 is also included. These buildings are over 30 years old and the construction of new entrances are required to reduce safety hazards and maintenance. Concrete stairway entrances are required at hillside locations to protect the hillside from erosion. Open steel stairway entrances will be utilized for multistory buildings.

E. Kennedy Space Center (KSC) 475,000

1. Construct Hazardous Waste Storage Facilities (Various Locations). 240,000

This project is the first phase of a multiyear program to provide hazardous waste storage facilities at 29 KSC and 6 Cape Canaveral Air Force Station (CCAFS) sites to comply with the Resource Conservation and Recovery Act in order to obtain the required State of Florida Department of Environmental Regulation operating permit. To meet the environmental requirements each site must contain sheds, concrete slabs with confinement curbs and appropriate access, waste fluid transfer capability (i.e., sumps, pumps, etc.), telephones, fire extinguishers/hoses, grounding systems, and fencing with warning signs. This phase will provide six sites at CCAFS, three sites at the Hypergolic Maintenance Facility, and seven sites in the LC-39 area that will meet the prescribed hazardous wastes storage criteria.

2. Install 13.8 kV Power Lines, Universal Camera Sites 9 and 10, Playalinda 235,000

This project installs approximately 5 miles (8.1 kilometers) of direct burial underground cable from the 13.8 kV Playalinda electric power substation at State Road 402 to Universal Camera Sites 9 and 10 on Beach Road, and will be connected at each site to a transformer suitable to supply the 60 Hz, 120-volt requirements. These sites, used for Shuttle support in tracking the SRB from separation to water landing, are currently powered with portable generators. This project will replace the frequently unreliable generator power sources, reduce the possibility of environmental pollution and/or fires from leaking fuel, reduce manpower currently required for 24-hour security to preclude pilferage at these remote sites, and eliminate expensive service/fueling demands associated with site-generated power. Simple payback for this project is 2-1/2 years.

F. Langley Research Center (LaRC) 760,000

1. Construction of Air Pressure Reducing Station (1247D) 150,000

This project provides for the construction of a 5,000/3,000-psi (34,500 kilonewton/square meter and 20,700 kilonewton/square meter) air pressure reducing station in Wlilding 1247D. The station will have the capability of recharging the 3,000-psi (20,700 kilonewton/square meter) buried storage field at a rate of 60 pounds/second (27 kilograms/second). An existing control room and steam heaters will be revised for this purpose. New equipment and construction includes pressure reducing, relief, isolation and vent valves; concrete slab, and roof shelter. Ancillary pipe and fittings will also be provided. Presently, a 3,000-psi (20,700 kilonewton/square meter) compressor is the only method of filling the storage field. The addition of the pressure reducing station will reduce recharging time and increase the reliability and frequency of operation.

2. Construction of Medium Bay Addition (1250) 230,000

This project provides for the construction of a medium bay 20-foot (7.2 meter) high addition on the southeast rear corner of Building 1250. The addition will consist of 2,200 square feet (204.3 square meters) of laboratory test space and a 450-square foot (41.8 square meter) equipment loading area with a canopy. The space will be used for test equipment, a control room, and storage. This addition is required for a new electromechanical vibration system and an area for fluid and pressure system assembly and testing. Both systems are used for testing and checkout of aerospace hardware.

3. Construction of Storage and Ramp Addition (1152) 175,000

This project provides for the construction of an 800-foot (74.3 square meter) storage and ramp addition to Wlilding 1152. It will provide increased operation and storage space for the existing rear loading platform.

The addition will have roof, wall and floor construction compatible with the existing structure. Also included is a utility elevator for moving paper goods. Currently, the loading ramp and adjacent corridor are overcrowded causing inefficient delivery procedures for the Publications Branch and Business Data Systems Division. This addition is required to improve the delivery situation and relieve congestion in the ramp area.

4. Construction of a Water Tunnel (1234) 205,000

This project provides for the construction of a water tunnel containing a test section which is approximately 2 square feet (0.6 meters). The tunnel will be constructed of wood and fiberglass and stand approximately 10 feet (3 meters) high. This facility will enable researchers to better understand flow phenomena that is associated with various aeronautical concepts. Through the use of flow visualization techniques in this tunnel, flow interaction can be observed and model changes can be made to eliminate undesirable flow regions.

G. Lewis Research Center (LeRC) 440,000

1. Construction of Engine Buildup Area, Propulsion System Laboratory (125) 110,000

This project will provide for the construction of an engine buildup area for test chambers 3 and 4 in the Propulsion System Laboratory (PSL), Building 125. This area which will be constructed in the northeast corner of the basement of the PSL will consist of an engine support stand, a steel bed plate, and four thrust blocks. The steel bed plate will be anchored to the existing concrete foundation and will support the engine stand. The four thrust blocks will be installed to resist forces applied during engine thrust system calibration tests. A traveling crane which services PSL's 3 and 4 on the first floor will be used to move engines from the engine stand in the basement to the test chambers on the first floor. This new engine buildup area will reduce down time between engine tests. With this buildup equipment installed, test engines can be mounted in this new area and then rapidly be installed in the test cell.

2. Construction of Addition to Main Gate Security and Visitor Control Center (108). 100,000

These resources provide for the construction of an approximately 400 square foot (37.2 square meter) addition to the northeast side of the Main Gate, Building 108. The enclosed brick structure will house an orientation area, a mechanical room and a storage space for audio/visual equipment. The new addition will contain necessary HVAC, electrical and telephone systems. This project also provides for modifications to the existing Building 108 which includes the installation of a new counter area with shelving for storage of supplies. The Main Gate Wlilding serves as a security office for controlling visitors, contractors, and NASA personnel entering/exiting the Center. The increasing number of contractors working at LeRC has resulted in

an increased requirement for a continuous program of contractor safety orientation. Deterioration within the existing facility has created a need for interior refurbishment. The work proposed in this project will provide a more efficient use of existing space and the addition of new space will allow for proper control and orientation of all persons entering the Center.

3. Construction of Storm Sewer..... 230,000

This project provides for the construction of a storm sewer to improve the drainage conditions adjacent to the Vertical Lift Fan Facility, Building 135. The work will include construction of approximately 320 linear feet (97.6 meters) of 4-foot (1.2 meter) diameter concrete pipe from the east side of Building 135 to an existing outfall into Abrams Creek. This work will also include two drop manholes; a concrete headwall; and related excavation, backfilling, and grading. This project provides for the extension of the existing concrete storm system which serves as an outfall for the Cleveland Municipal Airport. The ravine at the end of this outfall averages 15 feet (4.6 meters) in depth by 60 feet (18.3 meters) in width and is 330 feet (100.6 meters) in length. Erosion during periods of heavy rainfall is a serious maintenance problem. Construction of this storm sewer will eliminate this maintenance problem.

H. Marshall Space Flight Center (MSFC)..... 200,000

Addition to Preparation Shop at Test Stand 300 (4531) 200,000

These resources provide for construction of a 1,600-square foot (149 square meter) single story concrete masonry addition to the Preparation Shop, Support Building 4531, at Test Stand 300. This stand is used for simulating launch and space environment for product improvement and design verification testing of Shuttle thermal protection system (TPS) and other spacecraft components. The work in this project includes extension of the existing structure as well as all necessary architectural, structural, electrical, and heating, ventilating, and air-conditioning (HVAC) modifications within the existing structure to support this addition. The existing building houses mechanical tools, tube benders, electric drill presses, lathes, and mechanical technician tool boxes and equipment, as well as the HVAC equipment for Building 4530. With the addition of a 12-foot (3.5 meter) altitude test position at TS300, additional shop space is required to prepare the large items to be tested such as 4-foot by 8-foot (1.2 meter by 2.4 meter) built up foam insulation test panels of the lightweight external tank TPS.

I. National Space Technology Laboratories (NSTL)..... 490,000

1. Construction of Addition to Engineering Services Building (2104)..... 245,000

This project provides for the construction of a 3,000-square foot (279 square meter) addition to the Engineering Services Building 2104. Construction will include minimal site development, a concrete slab on grade; extension of a pre-engineered structure with insulated metal siding and roof; and the electrical, plumbing, and heating, ventilating, and air-conditioning (HVAC) systems. This addition provides for consolidation of approximately 20 engineering personnel, presently housed in three substandard wood frame houses, into a permanent type facility. The existing buildings do not provide an adequate environment for engineering and administrative activities, and are costly to maintain. The roofs, windows, and other components of these structures have deteriorated to the extent that the environmental conditions within the structures cannot be satisfactorily maintained. The wood buildings will be demolished.

2. Construction of a Multipurpose Conference/Educational Addition (1100)..... 245,000

This project provides for the construction of a 3,500-square foot (325 square meter) addition to the Administration Building 1100. The addition will be slab on grade with masonry walls and metal deck roof frame. Necessary HVAC, electrical, and plumbing will be included. The addition will be used by scientific and engineering personnel to conduct work shops, conferences, meetings, and seminars at NSTL. The facility will also be used to provide short training courses for mid-management level and administrative personnel, and graduate and post-graduate courses. These educational and training programs, as well as Source Evaluation Boards, are currently being conducted in a substandard trailer and other inadequate facilities.

J. Various Locations.. 200,000

1. Construction of Tracking Support Facility, Ponce de Leon, Florida..... 200,000

This project provides a 1,600-square foot (150 square meter) support building at the Ponce de Leon tracking station in Florida. Included are heating, ventilating, and air-conditioning systems, electrical power, fire protection systems, municipal domestic water system, and sanitary waste provisions. The existing electronic equipment trailers have deteriorated extensively in the highly corrosive salt atmosphere and sanitary facilities are inadequate. This station provides essential Space Shuttle launch data unobtainable through other tracking systems. This new support building will provide the necessary operations space for equipnent and personnel and will replace the deteriorating trailers. This tracking site will be required for the foreseeable future to support Space Shuttle launches.

TOTAL	4,800,000

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

An estimated $5,000,000 to $7,000,000 per year will be required for the continuation of this minor construction program.

FACILITY PLANNING
AND DESIGN

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1984 ESTIMATES

SUMMARY

FACILITY PLANNING AND DESIGN

	Amount	Page No.
Regular Requirements:	6,950,000	
Master Planning	200,000	12-2
Sustaining Engineering Support..	450,000	12-2
Preliminary Engineering Reports and Related Special Engineering Support..	2,300,000	12-5
Final Design.	4,000,000	12-6
Other Requirements:	2,250,000	
Space Shuttle Facility Planning and Design	1,350,000	12-6
Payload Facility Planning and Design	900,000	12-7
Total	9,200,000	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1984 ESTIMATES

PROJECT TITLE:	Facility Planning and Design		
		FY 1984 CoF ESTIMATE:	9,200,000
FY 1982:	$10,000,000	FY 1983:	$8,000,000

The funds requested in this estimate are required to provide for the following advance planning and design activities related to facilities activities and projects:

a. The accomplishment of necessary development and master planning for field installations and, where not otherwise provided for, the provision of continuing engineering support and special engineering management and other services.

b. The preparation of preliminary engineering reports, cost estimates, and design and construction schedules.

c. The preparation of final construction plans, specifications, and associated cost estimates and schedules required to implement construction projects.

d. The accomplishment of facilities siting and other investigations, studies and reports.

Regular requirements encompass the basic purposes outlined above. The "other requirements," while also in support of these purposes, cover those special needs related to large, complex projects or specific programs considered to represent high potential future construction requirements and for which early definition is essential. The large projects require more planning and longer lead time than is normally involved. Much of this planning must be completed prior to inclusion of the project in a budget request.

1. REGULAR REQUIREMENTS 6,950,000

A. Master Planning 200,000

Provides for the updating and further development of existing master plans for the field installations, including facility studies and site investigations. Documentation will define facility parameters within which subsequent engineering efforts will be based for future development. Provides for the documentation of existing plans where actions or deviations from previous plans have not been recorded for the various field installations.

Master plans at the various field installations are generally updated at cyclic 4-year intervals. Approximately one-fifth of the field installations are involved in any one fiscal year, keeping the level of effort relatively modest and constant. These plans provide for the orderly consideration of the allocation, proper arrangement, and efficient correlation of land areas and structures to serve the purpose of the various installations. Representative master planning activity candidates for FY 1984 are:

(1) Langley Research Center

An update of the facilities inventory base to include current utilization with emphasis on changes caused by the new National Transonic Facility and other recent facility construction and modifications.

(2) Goddard Space Flight Center

An update of the facilities inventory base to include the land use interfaces with the latest Agricultural Research Center planning and National Capital Planning Commission and land requirements for the remote test sites.

B. Sustaining Engineering Support 450,000

Provisions for facility studies and specific engineering support continue in importance as evidenced in recent years, and must be given high priority throughout FY 1984. These efforts are important due to the unpredictable cost situation which currently exists and may continue; cost trends in construction materials

and fuels; the continuing importance of energy conservation and efficiency; and the operation and maintenance cost for the physical plant. This includes provisions for maintaining a current engineering data base and updated construction specifications for utilization by the various field installations.

The following items are included in the FY 1984 requirements:

(1) Building Research Advisory Board Support

Covers annual support to the Federal Construction Council's (FCC) operations and provides for special studies that the Council will perform throughout FY 1984 to help advance the science and technology of Federal Government building and construction. The FCC is subordinate to the Advisory Board for the Built Environment, National Academy of Sciences, and its activities are supported by several Federal Agencies including NASA.

(2) Utilities Services/Rates Analysis

Provides resources for the availability of continuous services in support of utilities procurement and utilities control systems. This includes, but is not limited to, technical assistance, surveillance, and recommendations with regard to utility rates, contract negotiations, systems operations, and utilities control systems. Because of continuing increases in energy costs, these services are an annual requirement and continue to be essential.

These resources enable the Agency to insure that fair and reasonable rates are charged under its major utility contracts. Essential and valuable technical assistance is provided to our field installations so that effective negotiations can be conducted with utility companies Several major utility contracts per year require technical assistance as utility contract rates are renewed throughout the Agency.

NASA's significant ongoing investment in utility control and management systems requires a high level of technical maintenance and support. The proper function and operation of the equipment are essential in order to realize the benefits. These resources provide the high technical capabilities needed tc manage the system and insure proper operation and use.

These resources will provide for an updating of our system for forecasting utility costs and rates, so that better and more reliable utility budget requirements can be established. The accuracy and credibility of these forecasts impact the Agency's planning for other resources.

These and other similar utility system services are provided for by these resources in order to insure technical competence and properly manage this function.

(3) Facility Operation and Maintenance Analysis

Provides for continued engineering support for implementing improvements at NASA field installations relative to manpower utilization, work control systems, preventive maintenance, facilities management and reporting systems. Improvements will also involve techniques to identify where and how increases in productivity are possible by using earlier but still reliable measurement methods. Included in this activity are field surveys to be conducted on a priority basis at selected NASA field installations to evaluate the effectiveness of the operations and maintenance management systems.

(4) Value Engineering Cost Validations and Analyses

Provides for engineering services to improve cost-effectiveness of facility projects by subjecting project design criteria, specifications and working drawings for specific material components and systems to a detailed independent review by engineering specialists in the particular area of involvement. ***Also*** provides services necessary to accurately predict and validate facility costs which will aid in resources planning for the various field installations.

(5) Facilities Utilization Analyses

Provides for the analyses of Agency-wide facilities utilization data covering: (1) office and other types of building space; (2) designated major technical facilities; and (3) special studies comparing the utilization of technical facilities which are similar in type or capability, such as wind tunnels. Such analyses provide for: (1) insights into and development of better methods of identifying underutilized facilities; (2) imp-oved techniques of quantifying level of facilities use; and, (3) actions for improved facilities utilization. Work provides for review of each installation's inventory data base in support of the facilities utilization program. Surveys are necessary to validate the reported data in relation to a specific problem or'need, and to assist in providing a credible foundation for plans to improve the utilization of facilities.

(6) Environmental Studies

Provides for the identification of potential environmental problems or the quick resolution of any related controversies at the NASA field installations. These conditions may be brought about by:

- New federal, state and local environmental regulations, emission standards and environmental management planning programs that must be considered at various installations:
- Changes resulting from new or expanded program activities, new facilities, or major site expansions at NASA installations; and,
- Changes that take place in the external environmental conditions at NASA installations.

Early identification of potential environmental problems and quick resolution of these and related controversies at the installations are important. Project managers and facility planners require up-to-date, accurate information to comply with legal and regulatory requirements.

C. Preliminary Engineering Reports and Related Special Engineering Support 2,300,000

(1) Preliminary Engineering Reports (PER's) ..... (1,800,000)

Preparation of PER's, investigations, and project studies related to proposed facility projects in the FY 1986 and FY 1987 Construction of Facilities programs are provided for by this estimate. These reports are required to permit the early and timely development of the most suitable project to meet the stated functional need. Reports provide basic data, cost estimates and schedules relating to future budgetary proposals. This request provides for PER work associated with proposed construction except as provided for in other requirements (paragraph 2) for Shuttle, Spacelab, and Payload initiatives.

The estimated cost of PER support for FY 1986 construction projects is $1,100,000 which will permit updating of PERs for $25-30 million of construction, and the development of new PERs for an additional $35-40 million of projects.

An additional $700,000 has been included in this line for the completion of new PER's for approximately $30-35 million of construction projects which will be high priority candidates for inclusion in the FY 1987 Construction of Facilities program. The activity associated with FY 1987 will be confined to the most urgent and clear-cut priority candidates.

(2) Related Special Engineering Support ..... (500,000)

Investigations and project studies related to proposed facility projects to be included in the subsequent Construction of Facilities programs are provided for by this estimate. Such studies involve documentation and validation of "as built" conditions, survey/study of present condition of such items as roofing and cooling towers, utility plant condition and operational modes, analysis and support of environmental impact assessments and statements, and other like studies. These studies are required to allow for the timely development of projects to meet the stated functional needs and to provide basic data, cost estimates and schedules for related future budgetary proposals.

D. Final Design 4,000,000

The amount requested will provide for the preparation of designs, plans, drawings, and specifications necessary for the accomplishment of projects other than Space Shuttle, Spacelab, and Payloads initiatives. Amounts required for those efforts are included under other requirements (paragraph 2). Projects involved are planned for inclusion in the FY 1985 and FY 1986 programs. The goal is to obtain better facilities on line earlier at a lower cost.

The request will provide for final design work associated with construction proposed for the FY 1985 Program, estimated to cost $55 to $60 million, and for $8 to $12 million of high potential projects proposed for the FY 1986 program. The amount included for FY 1985 candidates and for residual requirements of this nature which have accumulated from prior years' final design activities is $3,400,000. For FY 1986, $600,000 is included and the supporting rationale is much the same as that set out in the PER estimate.

2 OTHER REQUIREMENTS..... 2,250,000

Other facilities planning and design requirements primarily associated with specific space programs characterized by large size, long planning cycle, and/or complexity of scope are included in this particular request. ,These programs require a level of planning effort and length of design time beyond more routine facility projects. These requirements must be provided beyond the regular and most recurrent facility planning and design needs.

A. Space Shuttle Facility Planning and Design.. 1,350,000

These resources provide for early and progressive design work, final drawings, specifications, and site investigations for future Space Shuttle facilities in order to insure the best design, good cost estimates and realistic construction schedules. The Shuttle operational era requirements include expansion of Kennedy

Space Center vehicle processing facilities to meet an increasing launch rate, construction of operations personnel facilities, modifications to the launch complex modifications at various locations for space engine testing, and additional facilities to support external tanks and other production facilities.

B. Payload Facility Planning and Design 900,000

Support of the operational phase of the STS payloads processing program will necessitate preparation of Preliminary Engineering Reports, facility site investigations, design of facility projects, and studies to determine facility capabilities. Included are Johnson Space Center facilities for payload static/dynamic testing and crew simulation facilities, expansion of Kennedy Space Center facilities to conduct cargo hazardous servicing and payload processing for the larger and more numerous payloads, as well as facilities projects for logistics and maintenance of payloads and storage of associated flight and support equipnent.

TOTAL **9,200,000**

REIMBURSEMENT TO GSA

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1984 ESTIMATES

SUMMARY

JOHNSON SPACE CENTER

	Amount	Page No.
Office of Management:		
Reimbursement to GSA for NASA Utilized Property at Ellington AFB, TX, as Directed by OMB.....	,400,0	CF 13-1

JOHNSON SPACE CENTER
FISCAL YEAR 1984 ESTIMATES
REIMBURSEMENT TO GSA FOR NASA UTILIZED PROPERTY AT
ELLINGTON AIR FORCE BASE, TEXAS AS DIRECTED BY OMB

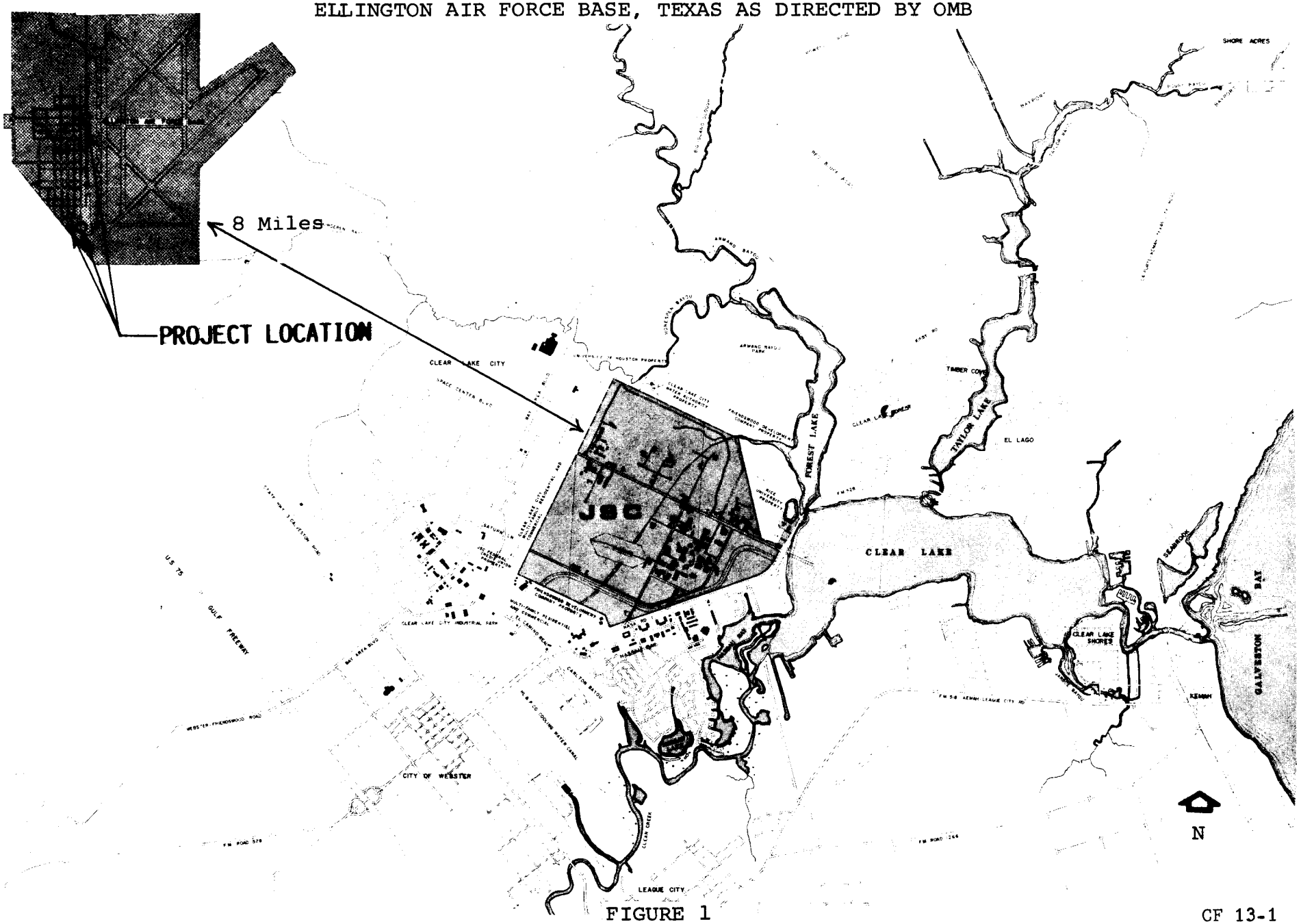

FIGURE 1

CF 13-1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1984 ESTIMATES

PROJECT TITLE: Reimbursement to GSA for NASA Utilized Property at Ellington AFB, TX, as Directed by OMB.

INSTALLATION: Lyndon B. Johnson Space Center

FY 1984 CoF ESTIMATE: $8,400,000

LOCATION OF PROJECT: Lyndon B. Johnson Space Center, Harris County, Texas

COGNIZANT HEADQUARTERS OFFICE: Office of Management

FY 1983 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	N/A	N/A	N/A
Capitalized investment	N/A	N/A	N/A
Total	N/A	N/A	N/A

SUMMARY PURPOSE AND SCOPE:

This project is submitted in keeping with the mandate issued by the Property Review Board/Office of Management and Budget in implementation of Executive Order 12348 of February 25, 1982. It provides for the transfer of real properties at Ellington Air Force Base (EAFB), Texas, to NASA Johnson Space Center (JSC) at a reimbursement cost of $8,400,000. The properties being transferred consist of three tracts of land totaling 33.4689 acres (13.5447 hectare) and the improvements thereon. Facilities within the acquired property line include aircraft hangars, warehouses, other support buildings, and utilities required to support aircraft operations. The facilities at EAFB have been declared excess to the needs of the Air Force, and the General Services Administration

is in the process of disposing of a major portion of the airfield. The transfer of these properties at EAFB to JSC is necessary to assure the availability of facilities for astronaut training in close proximity to the Center.

PROJECT JUSTIFICATION:

JSC has the major management responsibilities for the NASA manned spaceflight program. To accommodate the necessary aircraft operations and astronaut flying proficiency aspects of this program, JSC has used facilities and areas of EAFB continuously since 1961. When the Air Force declared this base excess to its needs in 1974, JSC evaluated other means for providing continued access to flightline facilities for the aircraft and training operations. Several alternate Government-owned airfields were considered. Alternates were discarded because a move to either of them would have caused a significant drain on the astronauts' available training time and would have been substantially more expensive than operating from EAFB. Commercial airfields in the vicinity of JSC were also surveyed but were incompatible due to air traffic congestion and lack of adequate ground facilities. The evaluation concluded that there is no viable alternate to EAFB for JSC aircraft operations.

The availability and use of the airfield facilities requested by JSC are essential for the continued maintenance and operation of aircraft assigned to the Center. The transfer of ownership of these real properties to JSC is the most effective means for assuring the availability of maintenance and operation facilities in view of the planned transfer of ownership of the air base from the Air Force to a non-federal agency.

IMPACT OF DELAY:

Delay in transfer of the EAFB properties to JSC will detract from the efficiency of maintaining and improving the facilities due to the uncertainties of future ownership of the airfield, with attendant adverse effects on JSC aircraft operations and astronaut flying proficiency program.

PROJECT DESCRIPTION:

These requested funds will provide for the transfer of three tracts of land and the improvements thereon at EAFB to NASA JSC. The three tracts comprise 33.4689 acres (13.5447 hectare) of land and contain 20 structures, including three aircraft hangars, nine storage facilities, five miscellaneous support buildings, and a fire protection system consisting of two water tanks and a pump station. These facilities, with access to the EAFB flightline, accommodate the maintenance and operation of aircraft assigned to JSC including 26 T-38 aircraft, 1 KC-135 aircraft, 1 B57 aircraft, 2 helicopters, and a C-97 aircraft.

PROJECT COST ESTIMATE:

This cost estimate is based on the General Services Administration's assessment of Fair Market Value.

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition	Acres	33.4689	43,560	1,457,905
Construction	---	---	---	6,942,095
Buildings	Gross SF	207,625	---	6,038,850
Other structures and facilities	Varies	---	---	178,245
Utilities	LS	---	---	725,000
Equipment	---	---	---	---
Fallout Shelter (none)	---	---	---	---
Total				8,400,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Site Plan

OTHER EQUIPMENT SUMMARY:

None.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No future CoF funding will be necessary to complete the transfer of this property to NASA.

JOHNSON SPACE CENTER
FISCAL YEAR 1984 ESTIMATES
REIMBURSEMENT TO GSA FOR NASA UTILIZED PROPERTY AT
ELLINGTON AIR FORCE BASE, TEXAS AS DIRECTED BY OMB

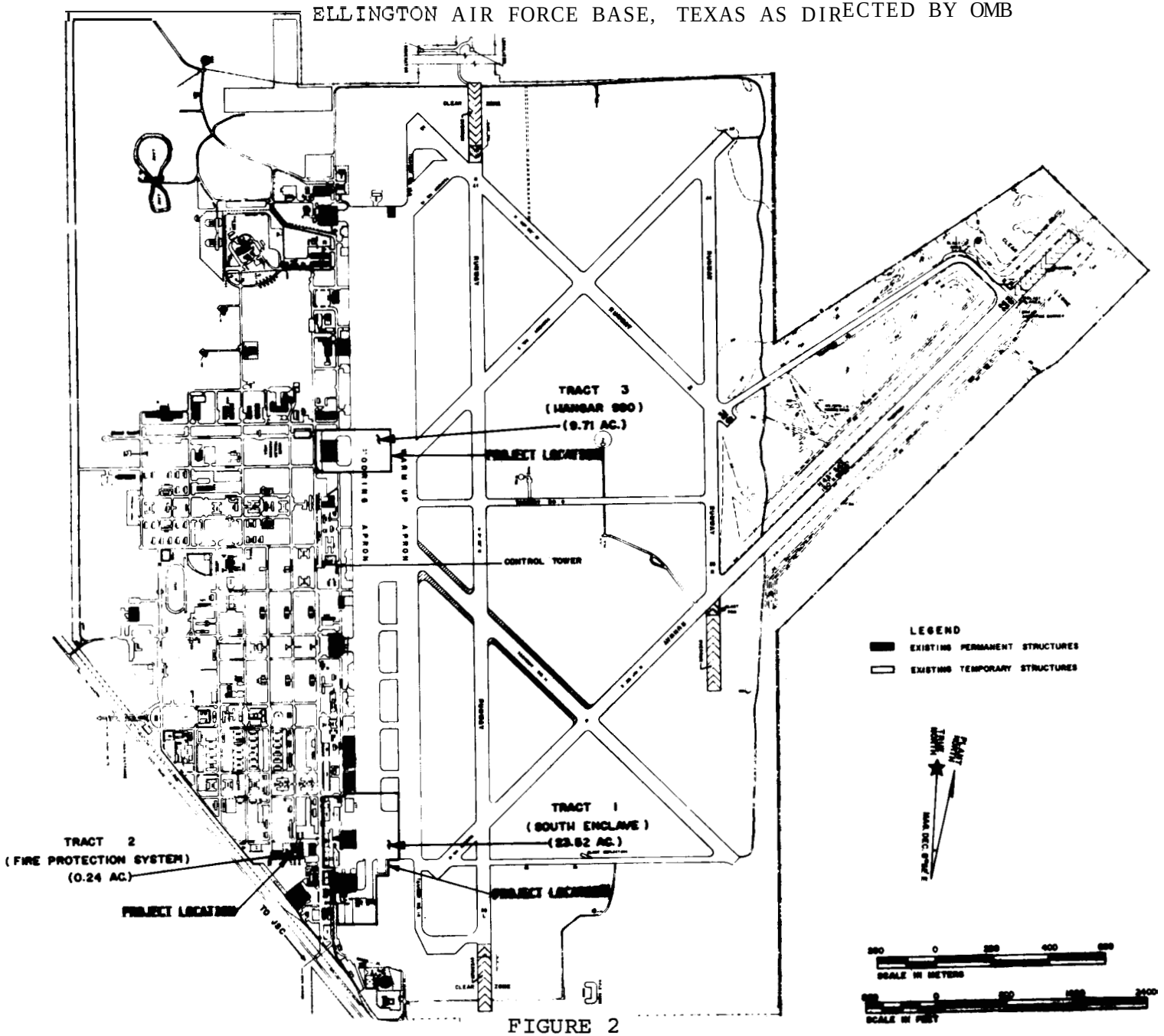

FIGURE 2

CF 13-5